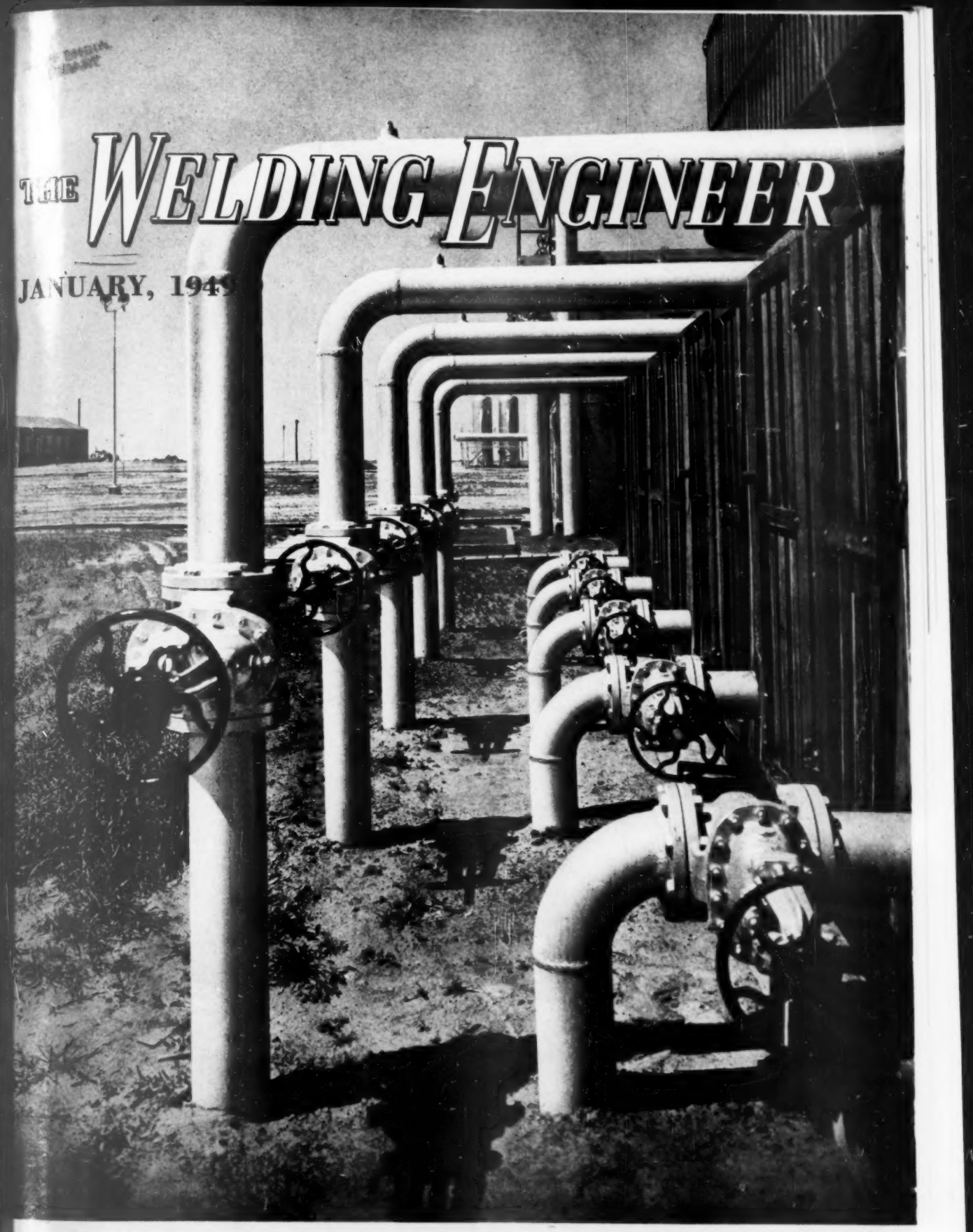

THE WELDING ENGINEER

JANUARY, 1949

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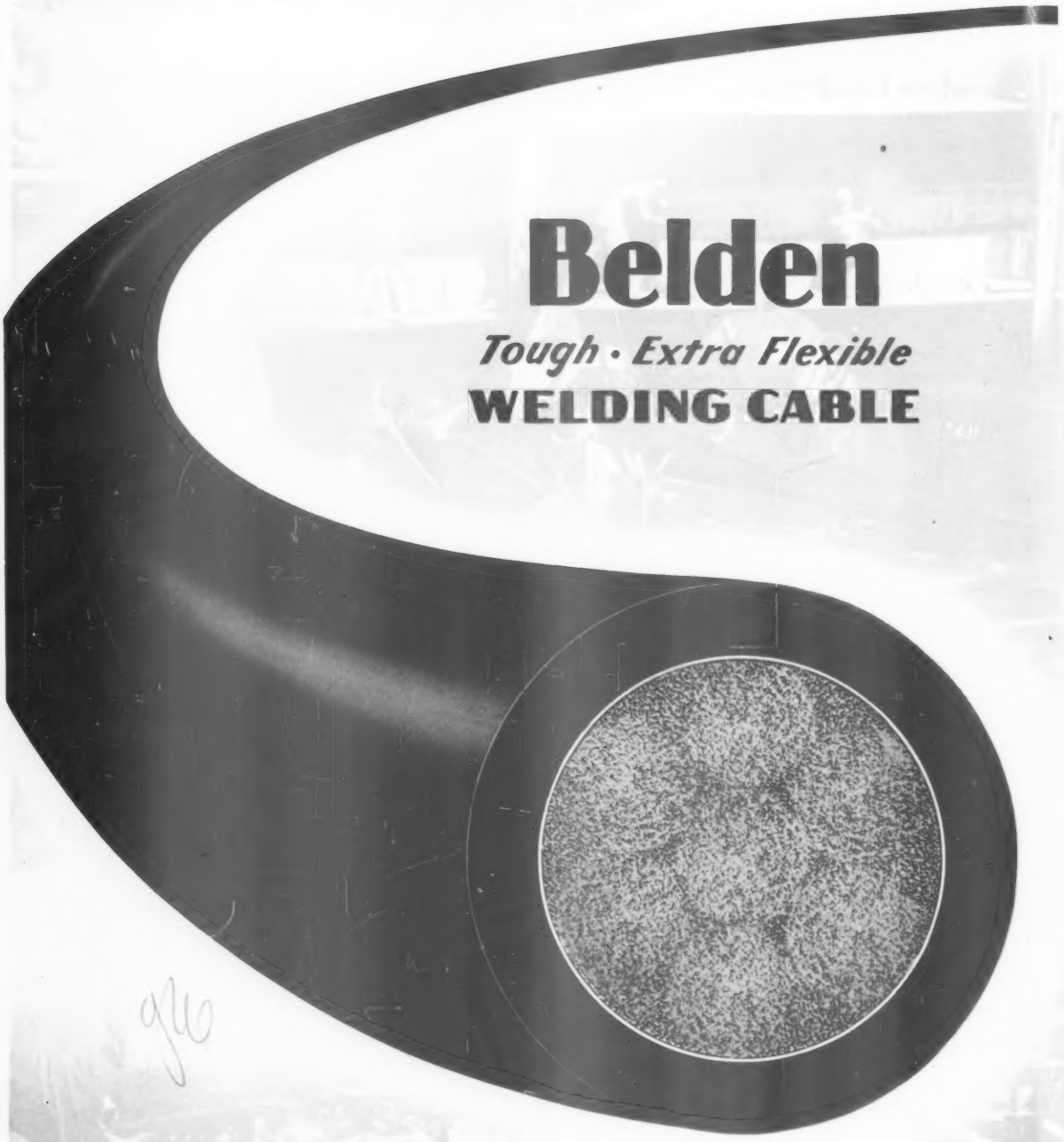

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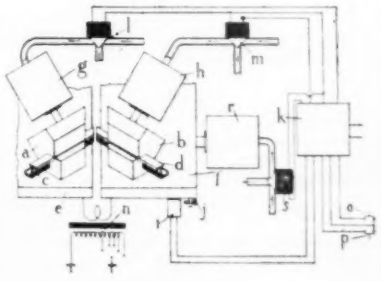
Resistance Welding Apparatus

2,481,317. BASIL HEATHCOTE LEPINE-WILLIAMS, Coventry, England. Filed Aug. 21, 1947. In Great Britain, Sept. 16, 1946. Granted Sept. 6, 1949.



Resistance welding apparatus includes a fixed head to support a first electrode and a movable table to support a second electrode. Movable clamping means on the fixed head secure the first electrode and the same method is used on the movable head. A delay device includes controls for moving the movable table and the clamping means. When the fixed head and movable table move toward each other a delayed cycle of operation is initiated including the releasing of clamps and movement of table away from the fixed head. Hand operated means control the closing of the clamps.

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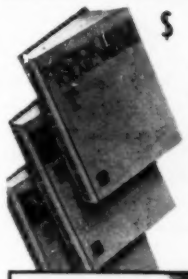

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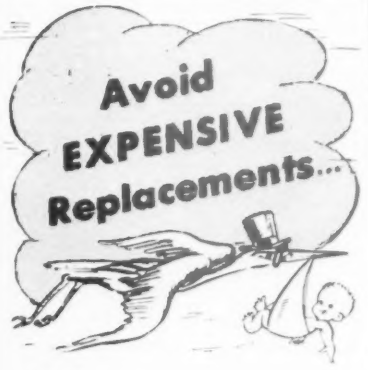

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THE WELDING ENGINEER

THE WELDING ENGINEER, *with which is combined The Acetylene Journal*

A McGRAW-HILL PUBLICATION

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THE WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

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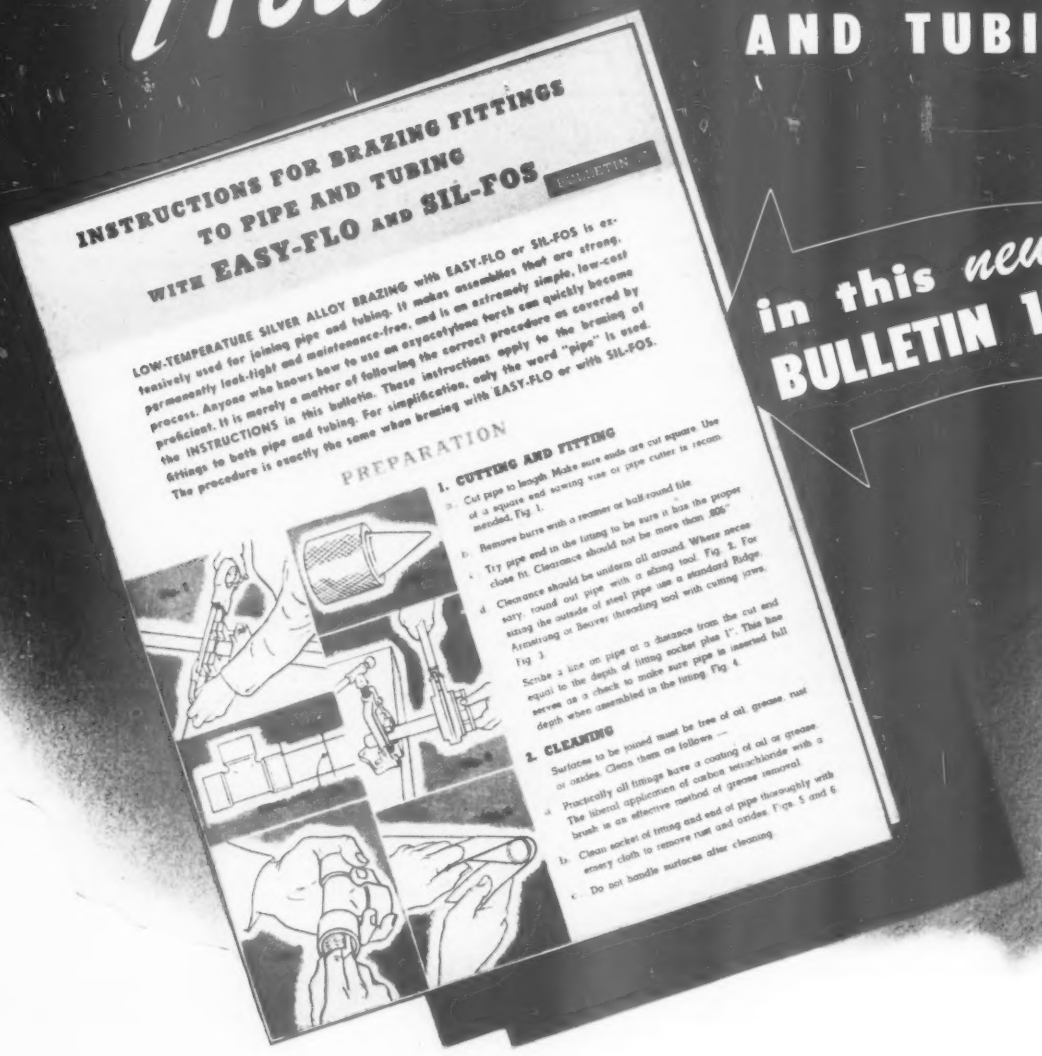
THE "How to" ON BRAZING PIPE AND TUBING


INSTRUCTIONS FOR BRAZING FITTINGS
TO PIPE AND TUBING
WITH EASY-FLO AND SIL-FOS
BULLETIN
LOW-TEMPERATURE SILVER ALLOY BRAZING with EASY-FLO or SIL-FOS is extensively used for joining pipe and tubing. It makes assemblies that are strong, permanently leak-tight and maintenance-free, and is an extremely simple, low-cost process. Anyone who knows how to use an oxyacetylene torch can quickly become proficient. It is merely a matter of following the correct procedure as covered by the INSTRUCTIONS in this bulletin. These instructions apply to the brazing of fittings to both pipe and tubing. For simplification, only the word "pipe" is used. The procedure is exactly the same when brazing with EASY-FLO or with SIL-FOS.
PREPARATION
1. CUTTING AND FITTING
a. Cut pipe to length. Make sure ends are cut square. Use of a square end sawing vise or pipe cutter is recommended. Fig. 1.
b. Remove burrs with a reamer or half-round file
c. Try pipe end in the fitting to be sure it has the proper close fit. Clearance should not be more than .006"
d. Clearance should be uniform all around. Where necessary, round out pipe with a sizing tool. Fig. 2. For sizing the outside of steel pipe use a standard Ridge, Armstrong or Beaver threading tool with cutting jaws. Fig. 3.
Scribe a line on pipe at a distance from the cut end equal to the depth of fitting socket plus 1". This line serves as a check to make sure pipe is inserted full depth when assembled in the fitting. Fig. 4.
2. CLEANING
Surfaces to be joined must be free of oil, grease, rust or oxides. Clean them as follows —
a. Practically all fittings have a coating of oil or grease. The liberal application of carbon tetrachloride with a brush is an effective method of grease removal.
b. Clean socket of fitting and end of pipe thoroughly with emery cloth to remove rust and oxides. Figs. 5 and 6
c. Do not handle surfaces after cleaning.

in this *new* BULLETIN 17

IF you do any brazing of pipe and tubing with EASY-FLO or SIL-FOS—or want to know just what the process is like you will find this new bulletin helpful. It gives the procedure, step by step, for—cutting and fitting—cleaning —fluxing—supporting assemblies—heating and flowing the alloys — cleaning after brazing. It tells how to make vertical up, vertical down and horizontal joints. Write today for a copy of BULLETIN 17.

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THE WELDING ENGINEER

JANUARY, 1949

Who Holds the Bag?

ANOTHER NEW YEAR, and instead of the customary resolutions let's take a minute to think. We in the United States are not fully aware of our blessings. There is no other nation in the world which offers so many opportunities.

In America, the son of a lowly immigrant can become president of one of our biggest banks, or a haberdashery clerk can become President of the United States. A person with sufficient ambition and desire can climb as far up the ladder of success as his abilities permit and perhaps a rung or two beyond.

One of the reasons why we are a great nation is that we have been the outstandingly successful nation in amplifying a comparatively trifling expenditure of human energy with a very large amount of energy from coal, oil or waterpower.

Certain propagandists will try to make you believe that mechanized industry has been detrimental to the people as a whole. Some of them are harmless professors of economics and social sciences whose minds are attuned to the time of Queen Elizabeth, long before the beginning of what they are fond of calling "the industrial revolution." More sinister are the propagandists who seek to change our basic American way of life by undermining our confidence in ourselves and in our institutions. They are opportunists, demagogues and just plain liars.

It's the little man who is king in America, and we can prove it.

Records of the Treasury Department and the Department of Commerce are of facts not fancies. These records show that only 10.2% of salaries and wages go to people with annual incomes of $5,000 and over, only 5.5% after deducting income taxes for this group.

Bloodsuckers and capitalists—the terms are used interchangeably by those with red axes to grind—are probably in the class of those with incomes of $25,000 and over. In our most lush war year, 1944, this group received but 1.3% of the national income. The rewards of bloodsucking would not appear to be too profitable.

It's the under $5,000 a year man who owns America. He collects 89.8% of all wages and salaries, 69.4% of interest and dividends, 83.1% of the rents. Unfortunately, the responsibility of ownership calls for sharing of the operating expenses. In plain English he pays income taxes, a very goodly share.

Taxes are higher than they should be because there are too many people on the government's payroll doing foolish things. With potatoes, for example. Since 1943 the government has been buying potatoes so as to make them cost 6 cents a pound at the market instead of something less than half that amount. Potatoes are the poor man's staple food. Why should his government want him to pay more? Sounds crazy, doesn't it, but you haven't heard anything yet.

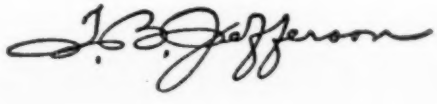
Uncle Sam has lost about $270,000,000 in his potato dealing. Our rich uncle buys a 100-lb bag of spuds in Maine at $2.90 and pays a $1.10 freight to ship it to Chicago, where it sells for around $4 in the grocery stores. But the government doesn't sell it at that price. Uncle Sam sells his $4 worth or spuds at just 1 cent per bag. Who's holding that bag? Brother, you and I as taxpayers.

On one such deal a farmer bought 1,800 bags for $18, then sold back the empty sacks at 10 cents each, receiving $180. He made $162 and got 180,000 lb of potatoes free. Simple arithmetic, but is it sense?

The deal is even better in West Virginia, where you can get 15 cents for each of the empty sacks. Why work for a living?

Our government also pays about $3.25 for 100 pounds of potatoes and sells them for 16 cents to makers of potato flour. The 100 pounds yield about 18 pounds of flour, for which the government pays $1.30. More confusin' than amusin'. Wonder if Little Abner is running this potato show?

How long can the United States remain the greatest nation on earth if it also persists in being the most foolish?



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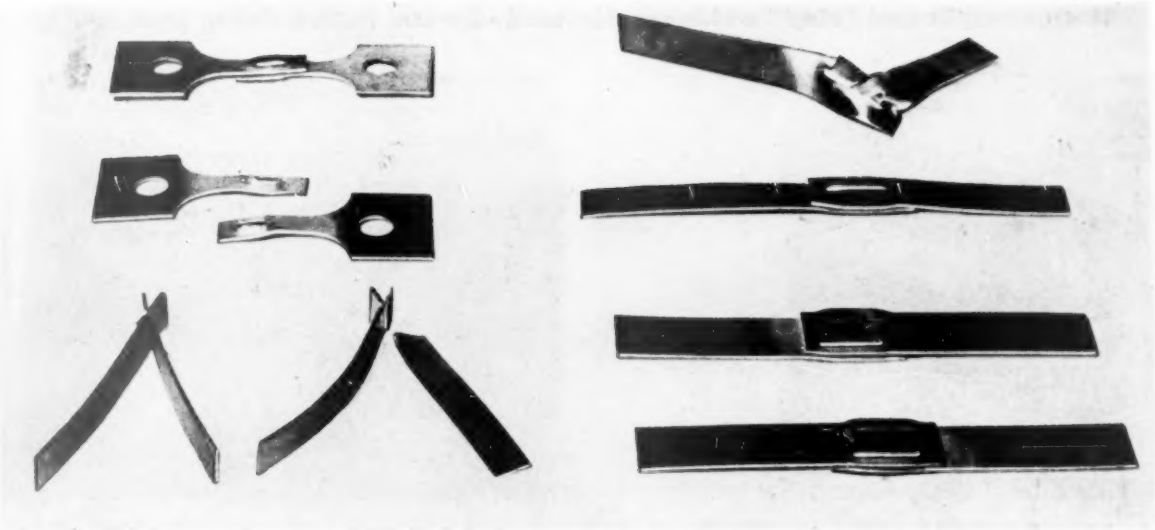


1—SPECIMEN WELDS parted in parent metal. Specimen in upper right-hand corner is a copper-to-aluminum weld

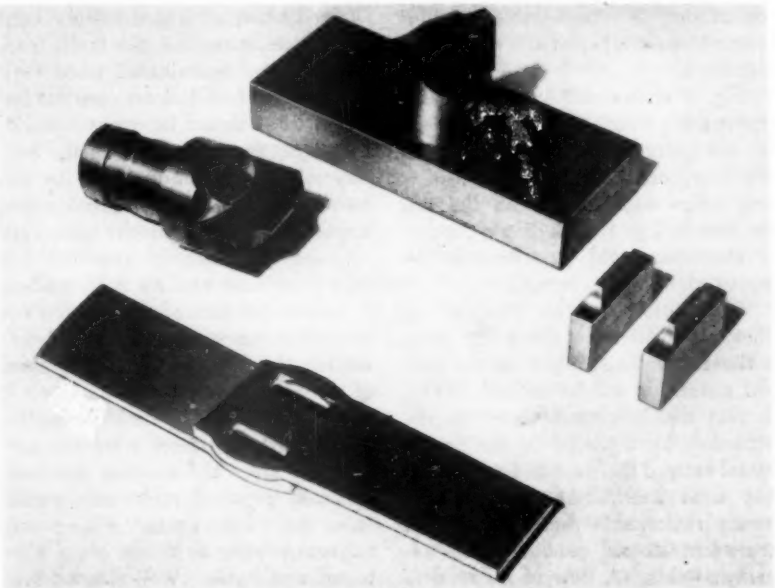
COLD WELDING

In this new British process, dies are used to force lapped sheets of aluminum together. If details are right, a perfect weld ensues—one made by pressure alone

RECENT investigations made in the British research laboratories of the General Electric Co., Ltd., Magnet House, Kingsway, London, W. C. 2, are likely to arouse considerable interest. As reported in the British publication, *The Engineer*, the General Electric experiments demonstrate that sheet aluminum and some aluminum alloys can be satisfactorily welded by the cold process.

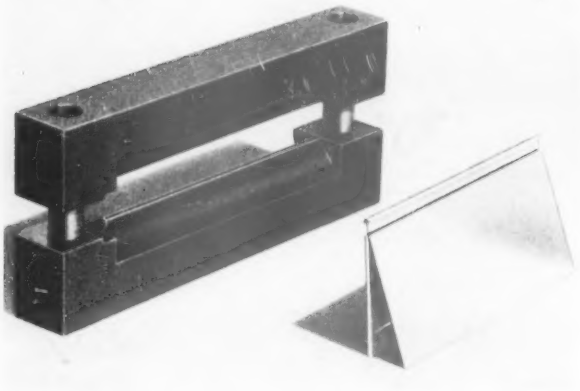
Hitherto, attempts to extend the use of cold welding have not awakened much attention, probably because such attempts were chiefly confined to copper. Since copper can easily be joined by soldering or brazing, the application of cold welding has been considered only in the few cases where it was desirable to avoid heating of the metal. Aluminum, however, is a different story. Despite all the attention which has been focused on the problem during recent years, no really simple method of welding aluminum alloys has been established.

As defined in *The Engineer*, cold welding is a process whereby ductile metals are welded by pressure alone. The pressure is applied to lapped workpieces of sheet metal by specially designed tool dies, mounted in a suitable type of press. Most of the dies are of mild steel (a chrome-manganese tool steel has also been

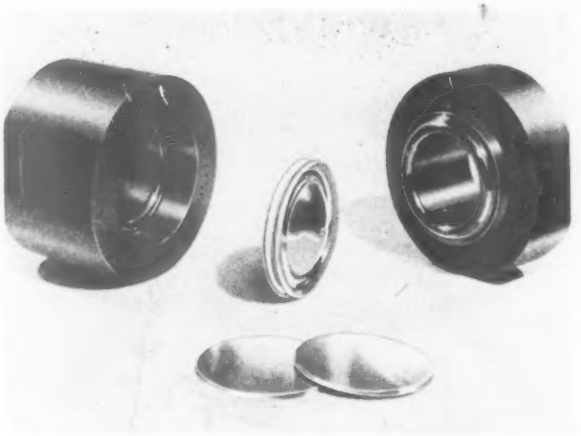


2—SIMPLE DIES, mounted and unmounted, for making short, straight welds. Note the indentations produced in welded specimen in foreground

Both straight and "ring" welds may be made by the cold-welding process. Another ap



3—LONGER WELDS than those of Fig. 2 are made with this type of die. Welded sample appears on the left



4—CIRCULAR DIES produce "ring welds" for joining two discs of the type shown in the foreground

found suitable) and produce corresponding indentations in the lapped specimens. There has been little evidence of wear even in the dies most extensively used.

Pressure required to effect a weld depends upon the working area of the dies. Pressures are generally slightly above the flow point of the material and range from 27,000 to 40,000 psi for aluminum and from two to four times as much for copper. Time during which the pressure is applied is not critical; good welds can be made with either slow squeeze or impact. Hand welding by impact on an anvil is quite feasible provided correct penetration of the die can be achieved.

Fig. 2 shows simple dies suitable for making short, straight welds such as are pictured on the specimen in the foreground. A number of other test strips welded by these dies can be seen in Fig. 1, including a copper-to-aluminum weld (specimen in the upper right-hand corner).

Weld joints can be arranged so that they will have about the same ultimate tensile strength as the parent metal. It will be noticed in Fig. 1 that the specimens tested to destruction have parted in the parent metal around the weld and not across the weld itself. At first sight it seems remarkable that so simple a treatment should produce such excellent welds. A flow of material is essential to satisfactory welding, and it does not seem possible that such a flow can be achieved by pressure alone. Yet that fact is true for the ductile metals, which can be made to flow cold.

Given a suitable arrangement of workpieces and dies, the application of pressure forces the work surfaces into close contact while the flow takes place, welding them solidly together. The work hardening that necessarily occurs is considered an advantage because it tends to balance the loss in strength resulting from the decrease in cross-section.

Sheets Must Be Clean

Production of a satisfactory cold weld necessitates that the faying surfaces be uncontaminated when they are brought into intimate contact between the dies. In more specific language, the oxide film on the surface of the aluminum must be removed, a fact which will not surprise anyone familiar with the elaborate cleaning preparations required before aluminum can be spot welded. A substantial part of the London experiments was concerned with determining the most practicable method of cleaning.

Chemical cleaning methods for the mating metal surfaces were not satisfactory since the washing that was generally required afterwards would form the oxide again. Filing and treatment with abrasives were also found unsuitable. Well cleaned surfaces, however, could be achieved with a motor-driven rotary wire brush operating at a surface speed of about 3,000 fpm. The technique was to keep the brush in contact with the work long enough for the operator to feel the "bite" when the steel wires broke through the oxide film into the metal below. It was sometimes advisable to degrease the surface prior to brushing to make sure that the steel wires of the brush would have their proper effect.

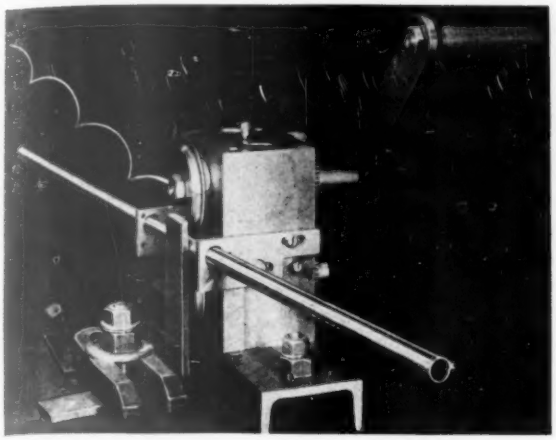
Once the surfaces are properly cleaned, it is necessary to avoid the reappearance of the oxide film. Fortunately, the re-formation of the film, though it begins immediately after cleaning, is not rapid. Provided the cleaned surfaces are not contaminated by handling, satisfactory cold welds can be made within 24 hours of the treatment. Cleanliness of the surfaces, it must be emphasized, is extremely critical. They must not be handled nor touched since the slight grease that exudes from the operator's fingertips is enough to prevent a weld from forming.

Pressure Requirements

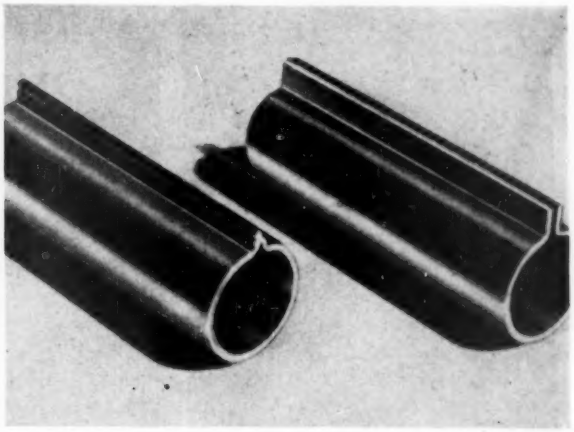
Further conditions are that the pressure be applied over a comparatively narrow strip and applied in such a manner that the metal can flow away from the weld at both sides. This state of affairs is achieved by applying the pressure between suitably constructed dies. Obviously, limits are imposed on the welding of complicated forms.

The combined thickness of the workpieces at the points of indenta-

application is to weld lapped flanges of tube blanks to produce continuous seams



5—CONTINUOUS SEAM welding of lapped flanges is a technique well suited to the manufacture of tubing



6—TUBING before (right) and after seam welding. Considerable metal has disappeared from the flange

tion constitutes an important criterion of a satisfactory weld. The combined thickness must be reduced by a certain minimum percentage, which is a characteristic of the material.

Figures of Merit

For convenience in comparing various metals, G-E engineers have derived "figures of merit" which indicate the maximum percentage of the double thickness that can remain when a good weld has been made. Some of these figures are: superpure aluminum 40; commercially pure aluminum 30; aluminum alloys 29-20; duraluminum 20; copper 14; nickel 11; silver 6. These figures indicate that the most satisfactory cold welds are likely to be made in aluminum, aluminum alloys and copper. A fact presently unexplained is that the figure of merit for welding aluminum to copper is the same as for aluminum to aluminum, but that for copper to copper is only half as large.

Once the minimum reduction necessary to produce a sound weld has been achieved, further reduction would reduce the strength of the weld by removing metal from it. Hence it is clearly desirable that no further reduction take place. To prevent it, the press in which the dies are mounted must be constructed so that it cannot be closed below the predetermined minimum.

It has been found that the required percentage reduction increases proportionately with the thickness of the metal to be welded unless the width of the dies is also increased. To illustrate typical dimensions involved, the unmounted dies at the right of Fig. 2 are ⅛-in. wide and give satisfactory welds in ⅛-in. sheet, as pictured in the foreground specimen.

From these basic ideas, three somewhat different techniques have been evolved, and all applications so far envisaged can be traced to one or another of them. The first is the long, straight weld, dies for which are illustrated in Fig. 3 alongside a specimen weld. Fig. 4 shows the second variant—the ring weld joining two discs by means of male and female circular dies. It will be observed that the metal inside the weld has been formed into a smooth convex surface. This curvature results from the flow of metal necessary to make the weld; it is, in fact, difficult to keep the area flat when using a cold welding technique.

The third and last technique, continuous seaming, is shown in Fig. 5. This application is particularly suitable for the manufacture of tubing. Comparison between the sections of tube before welding (right) of Fig. 6 and after welding (left) will reveal that the metal outside the weld has been trimmed to a considerable extent. The trimming is very evident in Fig. 5, which shows the machine in operation.

A further interesting development is that simple dies mounted in hand tools are quite satisfactory for producing cold welds in the thinner gauges of metal.

The simplicity of cold welding arises from the ease with which ductile metals flow under pressure. The limitations of the process also result from the same property. Although nearly all ductile metals can be cold welded, the process is actually useful with only a few of them.

Copper Joined to Aluminum

By using special dies with components of different surface areas, it has been found possible to weld copper to aluminum. A test specimen showing an aluminum strip joined to a copper strip is included (as previously mentioned) in the upper right-hand corner of Fig. 1. This particular technique may well prove to be useful in making electrical connections. With regard to the latter, some tests have revealed that the cold-welded joint has an electrical resistance only 80% of the parent metal.

These new developments fostered by the General Electric Co., Ltd., deserve the attention of all industries which use aluminum materials. In the course of time, the new process may even lead to considerable revision of current production methods. The importance of cold welding may be further enhanced by the encouragement which it can give to the replacement of steel by aluminum in certain applications—a most desirable objective in view of the seemingly insatiable demand for steel.

CORNER detail showing how truss ends were attached to columns

T1 CROSS TRUSS with hydraulic jacks in position at panel points for test loading. Upper truss is inverted so two top chords face each other

Trusses for Electronics

Steel roof trusses with welded joints were designed for buildings of Ge

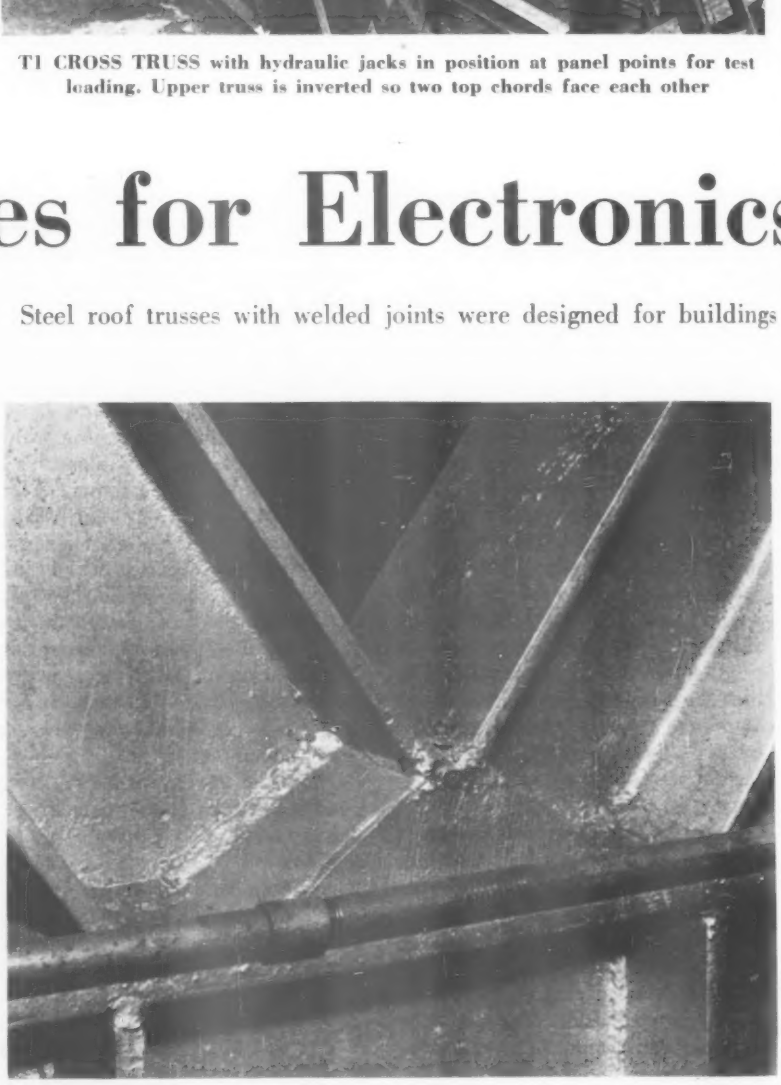
BY H. L. WAUGH

Giffels & Vallet, Inc., and L. Rossetti, Detroit

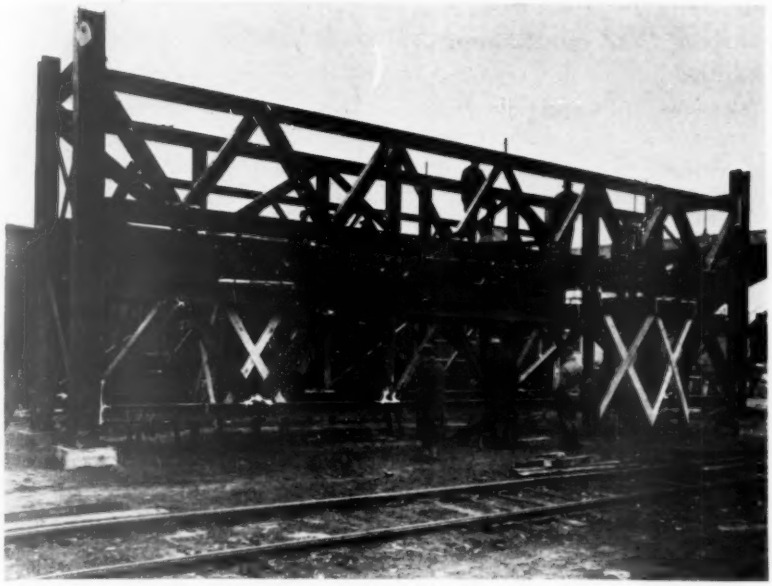
LANDSCAPED like a college campus, the recently completed Electronics Park project of the General Electric Co., near Syracuse, N. Y., consists of three separate manufacturing plants and a number of satellite buildings. The three manufacturing centers are a transmitter division building, a receiver plant and a miscellaneous specialties unit. In addition, there are administration and reception buildings, laboratory, cafeteria, service building and power house—nine separate structures in all. The project was designed by Giffels & Vallet, Inc., and L. Rossetti, associated engineers and architects.

Light and Airy

Each of the three manufacturing plants consists of a one-story factory section, a two-story laboratory section and a two-story office section.



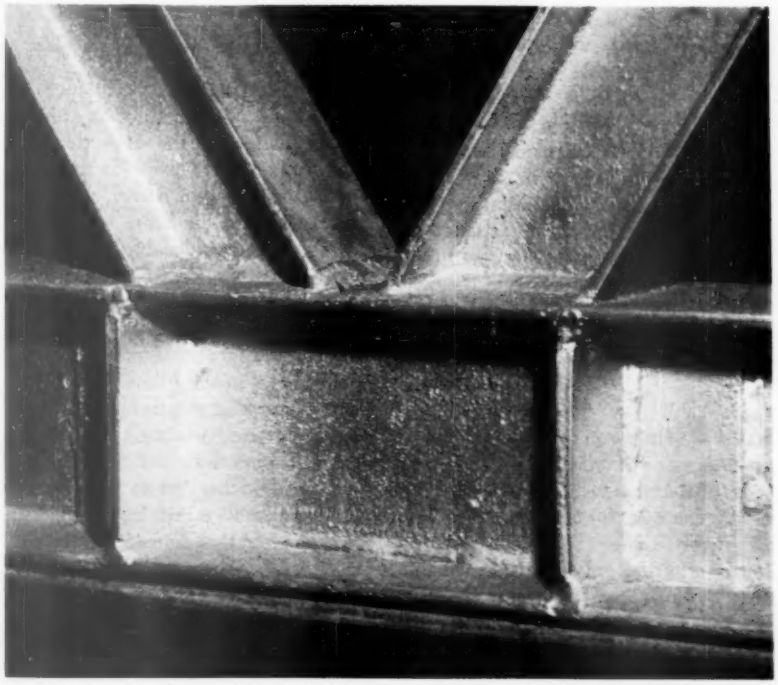
ATTACHMENT of 8-in. WF diagonal members to flanges of 8-in. and 10-in. WF chords of carrying trusses was effected by welding the inside flanges and webs of diagonals to a triangular steel prism the width of the chord



T20 SUPPORTING TRUSS under load, showing arrangement of jacks, pumps, gauges, deflection wires. Load was applied to total of 275,000 lb

Park Buildings

General Electric Company's new Electronics Park project near Syracuse



ON SMALLER cross trusses, centerlines were moved slightly apart, avoiding intermediary prism. Above method was followed for attachment of 4-in. diagonal to flanges of 6-in. chords and 5-in. diagonal to 8-in. chords

Instead of natural daylight, a fluorescent lighting system in all of the factory sections gives workers an average luminous intensity at their work tables of 40 candlepower. All of the buildings, with the exceptions of the service building and power house, are air conditioned.

Air conditioning of the factory sections is provided by fan houses on the roofs, so arranged that each fan house services from 12 to 15 factory bays. The many ducts needed for air conditioning are fitted into the roof-truss framing. Closely controlled temperature and humidity conditions are thus made possible for the exacting work of laboratory and manufacturing areas.

In both the transmitter and specialty manufacturing plants, present manufacturing processes as well as the foreseeable future appeared to be best fitted by 50-ft bays to span the widths of the buildings and 40-ft bays to span lengthwise. In the case of the receiver manufacturing plant, the layout of manufacturing facilities necessitated bays of 45-ft span across the building and 50-ft span lengthwise. These bay dimensions, of course, do not represent the full width or length of any building, several bays being necessary in both directions.

Roof Trusses

The cross trusses for all three factory sections were arranged to span the 40 or 45 ft direction of the bays. This meant that all of the supporting trusses for the three sections would be of 50-ft span. The spacing of the cross trusses was generally 16 ft 8 in.

Originally, the structural steel work was designed on the basis of riveted connections, and provision was made for the usual pair of heavy angles for the top chords of supporting trusses, lighter angles for top chords of cross trusses and pairs of channels for bottom chords of both cross and supporting trusses. After the design was well along, however, it was decided to change to welded connections. For the welded construction, wide-flange beams were selected for top and bottom chords. Trusses are Warren type.

Top chords of the cross trusses were made to slope in one direction only: back-to-back distance of the truss chords is 5 ft 0 in. at the shallow end and 5 ft 10 in. at the deep

Trusses were tested with hydraulic jacks under a set-up closely approximating field conditions

end. This arrangement requires the supporting trusses to be generally of two depths: 5 ft 10 in. and 6 ft 8 in. Trusses were framed with the bottom chords flush on the underside, facilitating conveyor installation, and the top chords of carrying trusses were arranged to support the concrete roof tile. Saddles of lightweight aggregate were provided along the shallow carrying trusses to slope the roof properly.

The entire space below the truss framing, a 15-ft clear height above the floor, is reserved for process equipment. The bottom chords are arranged to support such equipment in any position. Conveyors, for instance, can be supported in any position from the truss bottom chords. The space provided within the depth of the trusses is ample for the installation of the four key services: sprinkler system, ducts for air conditioning, fluorescent lighting and process piping.

Code Requirements

Most recent welding code of the American Institute of Steel Construction designates the type of construction chosen as Type 2. Type 2 connections assume that the ends of beams, girders and trusses are connected for shear only and are free to rotate under load.

The AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings by Arc and Gas Welding," 1942, governed all work erected under the structural steel contract. Because of provisions in this code limiting web widths to 12 times the thickness for compressive members and 16 times the thickness for tension members, the usual T-shaped sections listed in the steel handbooks would not meet the specification except in a few extreme cases. After thorough studies of sections available, the decision was reached to employ H-shaped sections throughout.

The H-sections were to be used for both top and bottom chords and the diagonals of all trusses. All members were to be turned so that the webs would lie in a vertical plane on the centerline of the truss.

To eliminate moments at the joints, the components were generally arranged so that their centerlines would meet in a point. On the heavy carrying trusses, this arrangement caused the adjacent flanges of the 8-in. diagonals to overlap where they met the chords. To effect such fabrication, a steel prism of triangular cross-section had to be cut and inserted for the full width of the chord flange, as shown in one of the accompanying pictures. The inserted bar also serves to provide a direct path for the flow of stresses through the joint.

No such intermediary prisms were needed for the smaller cross trusses since their centerlines could be moved slightly apart without undue moments being disclosed at the joints. The wider spacing also provided for easier welding methods.

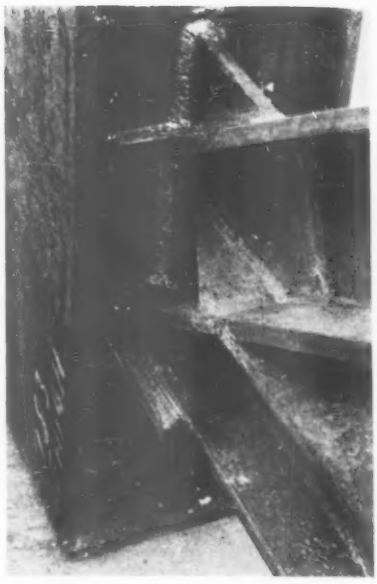
Where the transfer of the vertical shear stress across the joint became of major consideration, we provided shear and stiffener plates, adopting the criterion that at all locations where the web of the chord member required shear plates we would also provide stiffener plates opposite the outside flanges of the diagonal members.

Insofar as lighter cross trusses were concerned, we established the arbitrary rule that stiffener plates should be provided wherever shear plates were required. On heavy trusses, however, the inside flanges of diagonals were welded in close proximity through the medium of the previously mentioned triangular prism, which provided a path for the flow of part of the stress directly from flange to flange without being transferred through the chord members.

Electrode Specifications

E-6010 and E-6011 electrodes were used generally for single and multiple pass welds. E-6020 electrodes were permitted only for welds in the flat position, and E-6012 or E-6013 for the connection of materials of 5/16 in. or less thickness. Maximum electrode sizes permitted were 3/16 in. for E-6010 and E-6011, ¼ in. for E-6012, E-6013 and E-6020.

As far as cross trusses were concerned, one-pass fillet welds were generally all that were required. The heavy carrying trusses presented an entirely different problem. It was necessary to butt weld both flanges of the diagonal members to the chord flanges and to make a number of passes in order to provide sufficient weld metal for the full thickness of the connecting flange.

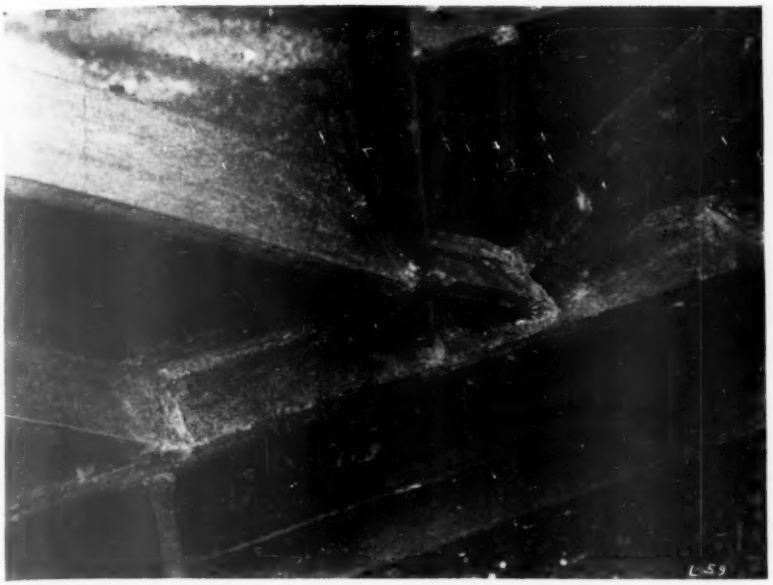


COLUMN and bottom chord connection of truss T65 after loading

Minimizing Stresses

Of necessity, the sequence of passes had to be carefully considered. If one flange of the H-section was completely welded prior to the welding of the opposite flange, we found that the axis of the beam was rotated through a considerable angle. To avoid this, we first considered the possibility of arranging the welds so as to put prestressed secondary stresses of opposite sign to the dead-load stresses in the joints. Upon comparing angles of rotation of the beam ends to stress, we soon discovered that this plan was not feasible and that it would be best to arrange the passes so as to minimize the uneven stress distribution caused by welding. On certain joints, our analysis showed that stresses in the welds and adjacent parent metal would extend beyond the elastic property of the material. Hence we could expect to have a cold flow of metal at these joints.

To satisfy ourselves regarding the



BOTTOM CHORD joint, third point, of 50-ft T65 truss as it looked under full load. The T65 truss was one of the three types of trusses tested

welded design, we specified that three pairs of trusses should be tested by jacking one truss against its fellow member of the pair. The trusses were placed in a vertical plane, one above the other, so that the top chords of upper and lower trusses faced towards each other. The upper truss was installed inverted so that it would be stressed as when set in the building. The trusses were separated by a vertical distance of approximately two feet to provide for the insertion of hydraulic jacks. Jacks with a ram diameter of 6½ in. were placed between the upper panel points of the lower truss and the lower panel points of the inverted upper truss.

Test Conditions

The trusses were supported at their ends by steel H-columns, connections to which closely approximated those of actual field conditions. The three pairs of trusses were connected together horizontally by bracing so that all six trusses were tied into a common framework. In order that the behavior of the welds might be more easily observed, each of the joints was given a coat of whitewash which would readily show up any cracks that might be developed under testing.

When the trusses were ready for testing, jacks were placed in position and suitable increments were applied by hand pumping until the trusses were carrying one and one-half times the design load. Midspan deflections were measured, and the welds were inspected for defects. Measured and computed deflections were in close agreement throughout the tests.

Truss Types Tested

At only one joint of the six trusses tested was flow of material detected; this occurred at an unusual joint involving both diagonals and verticals. The vertical passed through one-half the flange of the diagonal, causing additional and unequal welding to become necessary at this point with resultant stress increases.

The trusses selected for testing included a pair of 40-ft-span cross trusses designated as T1, a set of 50-ft supporting trusses known as T20 and a pair of 50-ft T65's designed for smaller loads than the T20 trusses.

T1 trusses had 6-in. WF 15.5-lb upper and lower chords and two 4-in. WF 10-lb diagonal members in each of the 8-ft panels. Jack loads were applied at each of the panel points in increments of about 3,000 lb up to 16,200 lb, at which load the midspan deflection was 9/16 in. The residual deflection or set was negligible after the load had been removed.

Trusses T20 had a 10-in. WF 112-lb by 49-ft-long top chord with one 8⅛ by ⅜ in. shear plate welded on each side of the web for the full length. The lower chord, an 8-in. WF 67-lb beam, 49 ft long, had two 6⅝ by ½ in. shear plates welded to the web for about 9 ft on either side of the center of the span. There were two diagonals in each 8-ft 4-in. panel. The end diagonal member was an 8-in. WF 58-lb beam, the next three diagonals 8-in. WF 48-lb and the center four diagonals 5-in. WF 13.5 lb. The load was applied at the third points in increments of 55,000 lb per pair of jacks until brought up to 275,000 lb when a deflection of 1¼ in. was measured. In this case, also, the set was negligible after removal of the load.

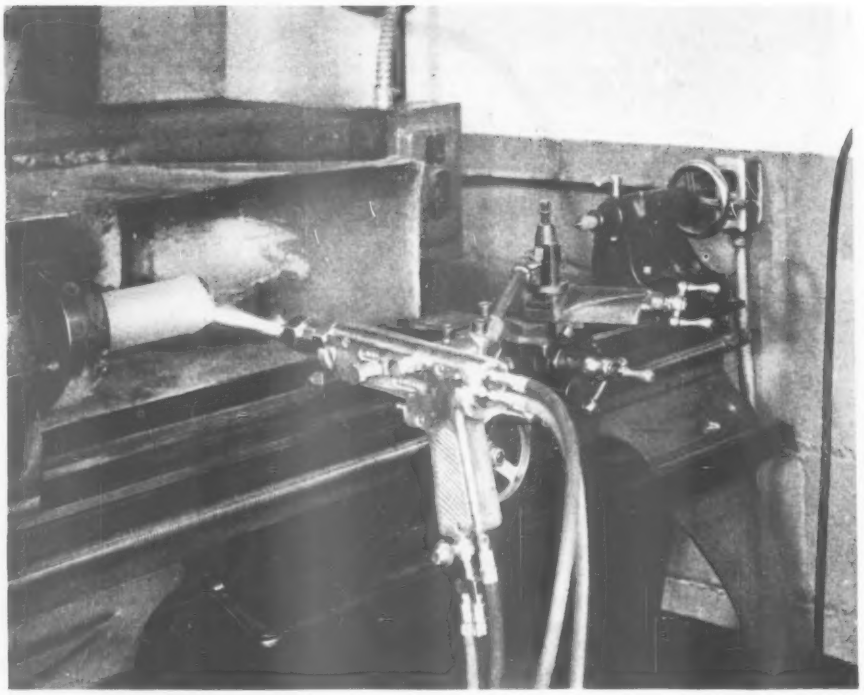
T65 Type Truss

The T65 type had about the same dimensions as the T20 but differed in having only one diagonal in each 8-ft 4-in. panel. Top chord was a 10-in. WF 112-lb beam about 50 ft long with two 8⅛ by ½ in. shear plates for the full length. Lower chord, an 8-in. WF 67-lb beam, had two 6⅝ by ½ in. shear plates along 19 ft 4 in. of the center portion. The end diagonal was an 8-in. WF 67-lb beam with two 6⅝ by ¼ in. shear plates; the adjacent diagonal 8-in. WF 58 lb and the center diagonals 5-in. WF 13.5 lb. The vertical members were composed of two 4 by 4 in. angles welded together by submerged-melt welding to form a Z-shape. The verticals were ⅜ in. thick at the first and center panel points and ¾ in. at the second panel point from each end. The load was applied at the third points in increments of 54,000 lb per pair of jacks up to 270,000 lb when the deflection was 1½ in. Here, too, the set was negligible upon removal of the load.

The load-carrying capacity of these trusses was not impaired by the tests, and they were afterwards used in the actual construction of the transmitter division building.

The tests, joint designs and welding procedure and sequence were made by the Lehigh Structural Steel Co., Allentown, Pa., which held the contract for fabrication and erection. Supervising the tests were: L. I. Bruce and C. L. Kreidler, Lehigh Structural Steel; W. R. Pressler and S. B. Barger, Pittsburgh Testing Laboratory; H. L. Waugh, Giffels & Vallet, Inc., and L. Rossetti; and E. R. Sangster, General Electric Realty Corp.

1—NO WEAR on hard-facing, yet above pump sleeve is no longer usable



4—HARD-FACING is in the flame. Though the powder is applied by a metallizing gun, process must not be confused with metallizing. Difference is that the sprayed deposit is fused to the base metal at 1,900 F with a torch, producing a molecular bond

Hard-facing Takes to Powder

Low-carbon steel can be readily hard-faced by any process, but new equipment and techniques are needed to handle such temperamental performers as steels of the AISI 400 series

BY LAWRENCE A. HOLTGREN AND RICHARD E. PARKER
L. A. Holtgren Co., Kenilworth, N. J.

FOR many years hard-facing has contributed in a large measure to increasing the life and reducing the number of failures in machine parts subjected to wear, corrosion or erosion or combinations of the three. Evidence of the basic place in industry occupied by hard-facing is proved by the multitude of applications which have increased part life, reduced "down time" for part replacement and made feasible operations which would be uneconomical or impracticable without the qualities of hard-facing.

Recognition of those qualities has in recent years stimulated the development and marketing of materials which give reasonable assurance that maximum performance will be obtained on a given job. In addition, significant changes and improvements have been made in techniques of application and other phases of processing, including finishing, to assure sound, blemish-free deposits on base metals heretofore considered non-weldable or, at best, hard-faced with indifferent results.

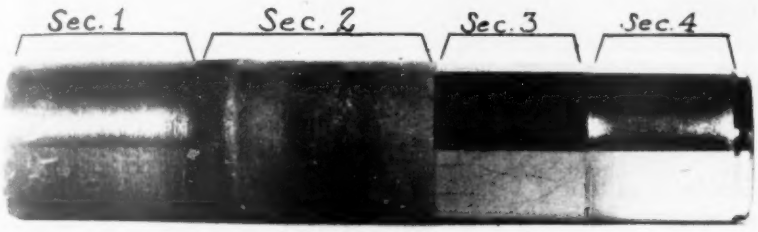
Applications involving the production or reclamation of parts may be divided into those which require finishing after hard-facing and rough applications such as are made on earth-moving equipment and the like. This article will consider only the former classification. References to hard-facing materials will relate only to the high-alloy iron base, chrome-cobalt and nickel-chromium-boron types.

Selection of Material

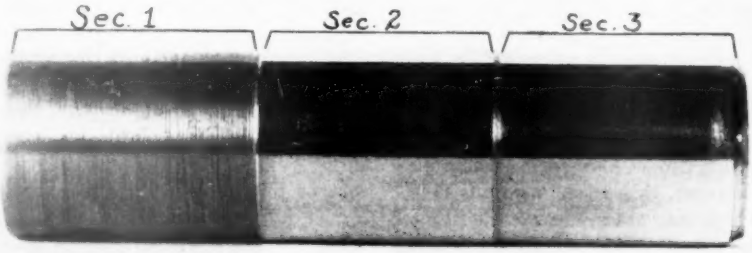
Despite the inherent qualities of most hard-facings, the wrong selection of hard-facing material or base metal or a faulty application has often precluded obtaining of the maximum part life. It is our purpose to discuss some of the factors which detract from the benefits of hard-facing and to suggest means of improvement.

Conditions of service vary over wide ranges, and vital considerations may be overlooked in selecting a suitable material. Important among these considerations are the following:

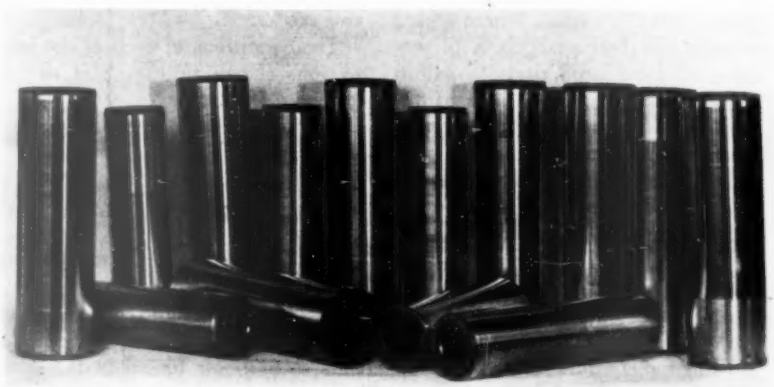
Abrasion (rolling or sliding)
Corrosion
Impact (edge or surface)
Erosion
Coefficient of friction
Operating temperature
Ease of application



2—CRACKING is inherent in steels of the AISI 400 series when hard-faced under normal procedures. Note the cracks in the tooled area of section 3



3—NO CRACKS in the tooled area, section 2, yet base metal is from same bar as Fig. 2. Both specimens are of AISI 416, a martensitic-type stainless steel



5—PUMP SLEEVES of the AISI 400 series (11-13% chromium) were hard-faced by the powder process and rough machined with special carbide tools

After the requirements of a particular application are evaluated, it is necessary to select the most desirable hard-facing. There is no method of comparison of the products of the various manufacturers other than that afforded by experience. Most manufacturers, however, have materials adapted to a wide variety of uses, and their recommendations may be depended upon. It must be borne in mind that there is no cure-all. Different services require different analyses of hard-facing alloy.

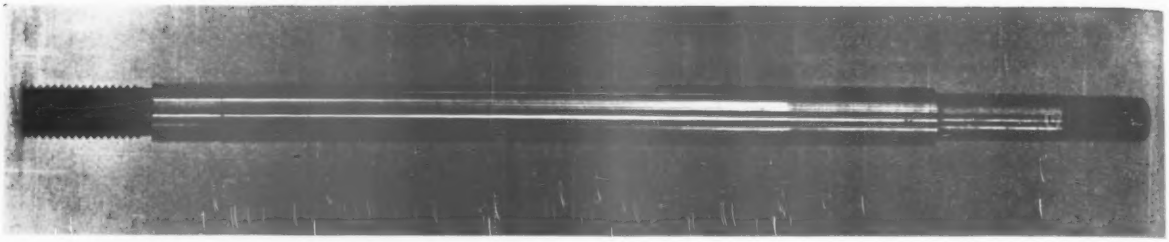
Selection of Base Metal

The application of hard-facing material to medium and low carbon steel presents the least difficulty. In general, sound deposits are obtained without cracking or checking of the surfacing material. Where conditions of service are such that low or medium carbon steel is satisfactory —where considerations of high tensile strength, corrosion resistance or other factors do not preclude its use —hard-facing will provide an economical, long wearing part.

In corrosive services, the use of non-resistant base metals has often resulted in the loss of the part before appreciable wear has occurred on the hard-facing. The 1020 steel pump sleeve in Fig. 1 illustrates this point. To provide corrosion resistance, common practice has been to cover the exposed surfaces with stainless steel weld deposits. This compromise has not been entirely satisfactory. The principal difficulty is that either or both the cover weld and hard-facing may crack and intergranular corrosion begin at points where carbides have been precipitated. Design of parts, selection of welding material and treatment after application are determining factors in reducing the tendency toward cracks and intergranular corrosion.

For all degrees of corrosive service, it has become standard practice in recent years to apply hard-facing to one of the 18-8 austenitic stainless steels (AISI 300 series). While this base metal has proved satisfactory in many respects, some problems have occurred due to:

1. Intergranular corrosion.
2. Strain checks or cracks occuring during processing or in service.



6—MONEL K pump rod was hard-faced by the powder process, machined and finish ground. The life of wear sections of pump rods may be increased many times by proper hard-facing. Life of the packing is also increased

3. Tendency to flow under heavy pressure.

4. Galling when close fits are involved.

Suggested solutions to the above conditions are as follows:

1. Use stabilized metal.

2. Because of wide variations in the coefficients of expansion of the stainless steels and the hard-facing materials, proper preheating and controlled cooling are essential.

3. Careful consideration must be given to design in order to avoid thin sections, particularly at points subject to heavy pressure.

4. Galling tendencies can be greatly reduced by finishing the mating surfaces in a manner to provide a supersmooth and level surface in terms of microinches.

Steels of 400 Series

Because of their unfavorable experiences with hard-faced 18-8 parts, some builders of equipment and operators have elected to use one of the AISI 400 series. These are 11-13% chrome, martensitic stainless steels which have been heat treated to produce the best wear-and-corrosion resisting properties. This type of material, properly heat treated, has been widely accepted in the refinery and chemical fields. In many instances, the 400 series has become standard in pumps, valves and compressors subject to wear, corrosion and erosion.

With all their desirable properties, steels of the 400 series have not been used as base metals for hard-facing because, until recently, it has been considered impossible to obtain a sound deposit free from cracks and checks. Recently developed hard-facing processes do assure sound deposits free from checks, cracks and other blemishes with 400 steels.

Though many of the failures in hard-faced parts may be attributed to improper selection of the base metal or surfacing material, poor performance in a great majority of cases is the direct result of faulty application or improper treatment before and after application.

Most frequent results of poor techniques include: blowholes, lack of bonding to the base metal, soft spots and checking or cracking. Each of these faults is caused by one or more errors of technique or processing. The first two (blowholes and poor bonding) may be corrected by strict adherence to the hard-facing manufacturer's recommendations. Soft spots may also be eliminated by applying proper hard-facing techniques. However, this is an insidious defect which may not be detected until after the part is in use and uneven wear or a corrosive attack has rendered the soft spots apparent. Grinding, the most common method of removing excess hard-facing material and finishing, is apt to cause the metal to smear and thus cover or camouflage the bad spots. If the deposit is machined or tooled, however, the most minute defects are disclosed, whether spots, checks or cracks. Where design permits, the best practice is to machine all hard-faced parts to within a few thousandths of an inch of finished size as insurance against any flaws. Special grades of carbide tools are required to tool the harder types of hard-facing, but the assurance of no soft spots will pay dividends in the long run.

The fourth class of defects includes those classed as checks and cracks. These are due to the differences in the coefficients of expansion of the base metal and the hard-facing and to the relative speed of contraction of each during the cooling period. They may range from hairline and almost invisible fissures to a "mud flat" pattern with considerable separation of the edges of the cracks. For some services, minute cracks may be of minor importance and have very little influence on the life of the part. In services involving corrosive action, however, their elimination is a prime consideration. To avoid checks and cracks, it is necessary to retard the rate of cooling to reduce thermal shock.

As we have already mentioned, steels in the AISI 400 series have not been satisfactory for hard-facing because of checks and cracks. Such checking occurs not only during the cooling period but frequently after an appreciable lapse of time, even during the storage of finished part. Fig. 2 illustrates the cracking inherent in hard-facing these types under normal procedures. The bar used for the demonstration is AISI 416, a free-machining stainless steel. The base metal was undercut to allow application of a hard-faced deposit approximately 0.060 in. thick and of 58 Rockwell C hardness. After hard-facing, the whole piece was brought to a uniform temperature and slow cooled, employing every normal precaution to prevent checks and cracks.

The conditions of each of the four sections shown in Fig. 2 is as follows:

Section 1. Base metal rough machined.

Section 2. As-welded deposit without machining or grinding. No cracks are visible.

Section 3. Tooled area showing cracks.

Section 4. Ground finish, illustrating how grinding covers defects. This section was tooled in the same manner and at the same time as section 3. Cracks were visible to the same degree as in section 3, but the finish grinding effectively eliminated all visible flaws.

Fig. 3 illustrates the effectiveness

of new procedures. The base metal was from the same bar as that in Fig. 2. Section 1 in Fig. 3 is the rough-machined base metal. Section 2 shows the tooled surface of the hard-faced portion, and section 3 the ground surface. The piece has been subjected to considerable thermal and mechanical shocks after processing and is entirely free of cracks. Like results have been obtained on AISI types 410, 420 and 440. The same hard-facing methods have been used with remarkable success in the manufacture of machine parts including shaft sleeves, pump rods, plungers and mechanical seal rings.

Powder Hard-Facing

The process consists of hard-facing with powder, applied by a metallizing gun (Fig. 4). The process should not be confused with metallizing, however, as the deposit is fused to the base metal, producing a molecular bond. The part is first sprayed with the hard-facing powder, then heated to fusing temperature (1,900 F) with a large multiflame oxyacetylene torch. Immediately after fusing, the part is placed in a furnace at approximately 1,800 F and allowed to cool at a rate of 50 to 150 F per hour. The resulting layer of hard-facing is a homogeneous mass without porosity.

The types and kinds of hard-facings in rod form far exceed those currently available as powder. Nevertheless, the available hard-facing powders cover a very wide range of uses. Performance has been excellent under severe service conditions.

The relatively recent development of the "Sprayweld" process and other techniques in the use of powder has made it possible to hard-face many more sizes and shapes than could be done economically by the use of metals in rod form. Long small-diameter shafts, shaft sleeves (reclaimed after use) and large plungers have been successfully hard-faced. Reclaimed parts, which were originally heat treated or otherwise hardened, have had much longer life after hard-facing reclamation than before.

The process also makes it possible to hard-face base metals which do not readily accept the conventional application of the hard-facing rod. The previously discussed hard-facing of AISI type 416 stainless is one example.

Fig. 5 shows a group of pump sleeves made of stainless steels in the 400 series. These were hard-faced by the powder process and rough machined with carbide tools to bring out defects. Hardness of deposit is 58 Rockwell C. Shrinkage cracks are conspicuously absent. Another interesting example is a powder hard-faced Monel K pump rod, machined and finish ground as shown in Fig. 6.

Important factors in the success of the method are that the part is uniformly heated over the whole weld area, comparatively low heat is required, application is simple, distortion held to a minimum and subsequent tooling or grinding reduced. For many services, the as-deposited metal is sufficiently smooth, requiring no finishing operation whatsoever.

Although powder welding has many advantages, care and attention to detail are imperative to the production of perfect work. One of the most frequent difficulties experienced is peeling of the sprayed deposit during the fusing operation. Principal factors causing this condition are:

1. Failure to bring the base metal up to sufficient heat to permit the deposit to fuse to the surface.

2. Spraying up to sharp corners or progressing from heavy to thin sections.

3. Insufficient cleaning of the base metal before grit blasting.

4. Improper material or methods used for roughening the surface to secure the initial mechanical bond. Sandblasting contaminates the metal; neither rough grinding nor tooling produces the best surface.

5. Warping of the base metal before the hard-facing is fused.

6. Too thick or too wide variations in the thickness of the sprayed deposit.

Recommended Procedure

1. Clean the surface to be hard-faced with a good volatile cleaner such as carbon tetrachloride. Be sure that there are no pits nor holes to harbor sand, oil or other foreign matter and that all scale has been removed. The surface should be bright, clean and smooth.

2. Blast the surface with sharp steel grit. (Aluminum oxide may be used if the dust is removed by air cleaning after blasting.) The blasting should continue until the part has a matte finish with no sheen. Care must be exercised so that the surface is not contaminated with fingerprints, rubbed against other objects or left where dust may collect.

3. Spray the powder in thin, even coats over the whole surface. The first coat should be applied as quickly and evenly as possible in order to stop the formation of surface oxides due to the heat imparted by the sprayed metal.

4. Fusing should follow immediately after spraying. Whenever possible, the part should be surrounded with firebrick or other suitable refractory material, leaving only sufficient space to wield the torch. Bring the part up to heat slowly, and be careful not to concentrate the heat at any one spot. On a large part, it is not necessary for the whole to be heated to the fusing point, but all areas adjacent to the hard-facing must be brought up to and kept at heat during fusing. It is generally good practice to tack the edges before continuing with the rest of the surface. Warping of thin sections will cause the sprayed deposit to lift and refuse to bond. It is advisable that thin sections be clamped securely and that all parts be stress-relieved before hard-facing.

5. The rate of cooling after fusing will depend upon the mass of the part, variations in section and the type of base metal. Normally the part should be slow cooled in asbestos, lime or other similar material; common practices in cooling after welding will be adequate. For certain alloys, it is advisable to furnace cool at a rate of from 50 to 100 F per hour.

As new techniques, materials and processes are developed, the uses to which hard-facing can be adapted will be multiplied. Present indications are that small bores may be successfully coated. Sharp edges and square corners are now being produced as a routine procedure. In addition, certain hard-facing alloys are adaptable for use as a brazing metal for corrosive service where the common materials are not sufficiently resistant to attack.

Improved, simplified and rendered more versatile by current developments, hard-facing will become of increasingly greater importance in the solution of industry's production and maintenance problems.

2—SEAM WELDING joins an upper onto small transformer tank near the end of the "fast" production line

3—COOLING FINS are seam welded to tank in the "slow" line. The L-shaped holder facilitates handling

Seam Welding S

Every new farm added to an electric line means a new distribution transformer. Basically, such a transformer is a tank, which can be resistance welded together on an assembly line

BY WALTER RUDOLPH

TRANSFORMER Division of Westinghouse Electric Corp., Sharon, Pa., is currently making every effort to meet an unprecedented demand for transformers. Production has been streamlined in all phases of manufacture, and some interesting welding procedures are included in the overall picture, as photos show.

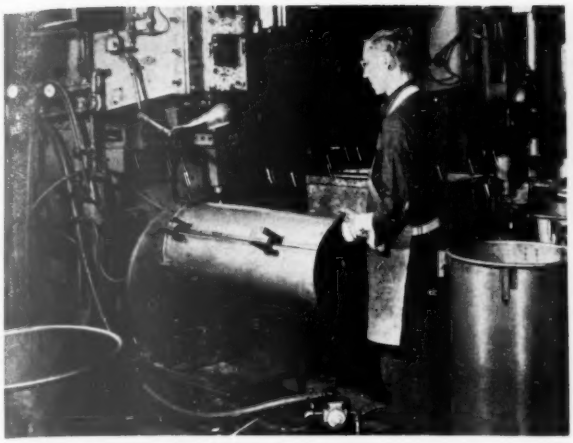
1—ROLLED SHELLS for transformer tanks come down incline at right to flash welder, are shoved to next operation down incline in foreground

Especially critical items are small distribution transformers, ranging from a foot or so in diameter to about 20 in. in diameter and up to 5 ft. long. These are urgently needed for farm electrification. Their fabrication has been set up in as near to straight-line production as is feasible. For instance:

Sheets of 20 5/16 by 36¼ in. steel, 0.078 in. thick, are received at a forming roller installed in one corner of the welding department. The rolled shell is placed on a slightly inclined counter or table (Fig. 1), the opposite end of which is just to the right of a flash welder, capable of handling tank diameters from 11¼ to 13¼ in.

About 350 tanks can be processed in an eight-hour shift. The operator simply takes a rolled strip from the right table in Fig. 1, welds the longitudinal seam and places the partially completed tank on a similar table that juts off to his left. There it moves gradually to the next work station, a stripper installation, where excess metal is stripped from the welded seam.

It is merely a few feet from the stripper to a custom built hydraulic press that utilizes up to 50 tons of pressure to put ¾-in.-radius flanges on the tanks. From then on through this particular part of the welding department, sometimes called the



4—GALVANIZED ground studs are projection welded near top of larger tank on the slow production line

5—DOUBLE ROLLER adds a tank bottom to the side walls. A lubricant is enclosed within the double seam

Speeds Transformers

"fast" line, the tank is passed manually from one machine to another, gradually having hangers, studs, nameplates, etc., welded on by specific machines set up for the job. Near the end of the fast line, an upper portion is seam welded to the tank (Fig. 2).

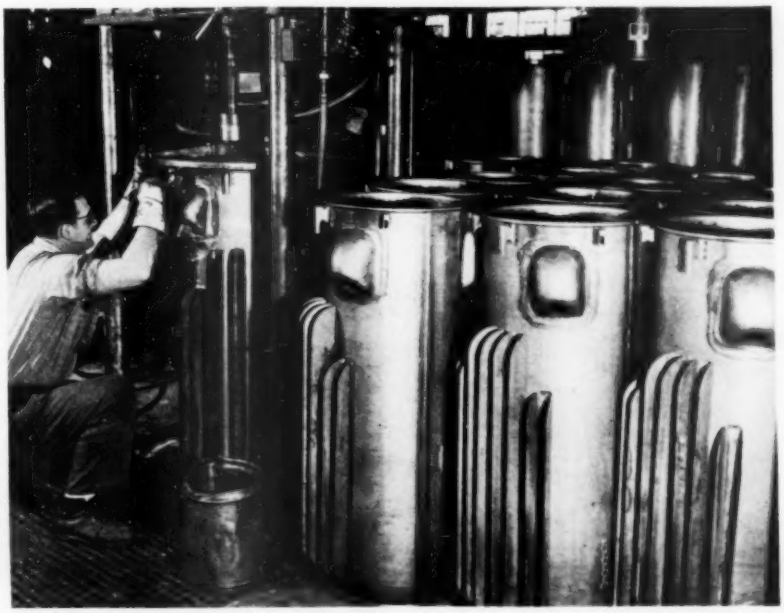
Adjacent to the fast line is the so-called "slow" line, which handles mostly the larger size transformer tanks; *i.e.*, about 18 in. in diameter and up. Typical of operations is one where double-edged cooling fins are welded onto sides of transformer tanks, four to a side or eight in all. These fins have flat bases that can be seam welded to the tank (Fig. 3). Four or five tanks an hour can be handled.

One of the aids to handling large tanks is an L-shaped arm just in front of the seam welder shown in Fig. 3. The longest part of the L swings or rotates on the shorter arm, secured to the floor to hold the tank during welding.

The large transformers are also passed manually from machine to machine in the slow line to get ground studs, hangers, cover lugs, etc. at the individual machines. Typical of these smaller welding operations is that shown in Fig. 4, the projection welding of two galvanized ground studs. These are fastened near the top end of the tank.

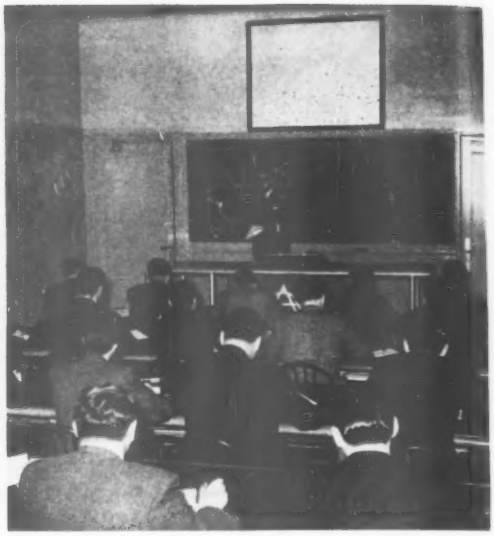
One of the most interesting operations is the use of a cam-activated double roller to fasten the walls of the tank to the bottom (Fig. 5). The double rolling operation is necessitated because a double seam is required to fasten the two pieces. A rod or plunger passes through the top of the tank to aid in the fastening, and a paintlike lubricant is applied as the rolling progresses. Besides aiding the joining process, the lubricant acts as a corrosion-resistant in the seam.

The completed transformers are moved to a vertical testing stand (Fig. 6). A lid is clamped on the top of the tank and about 22 psi of air pressure is applied inside. The welded fittings, fins, pockets, bottom, etc. are painted in the usual way with a soapy compound. Any leakage of air is swiftly detected.



6—TESTING STAND uses air pressure of 22 psi to detect leaks in the welded transformer. Operator is painting a soapy compound over the welds

NEAT BOOTHS are provided for arc welding. Red and green lights on front indicate whether or not welder is being used



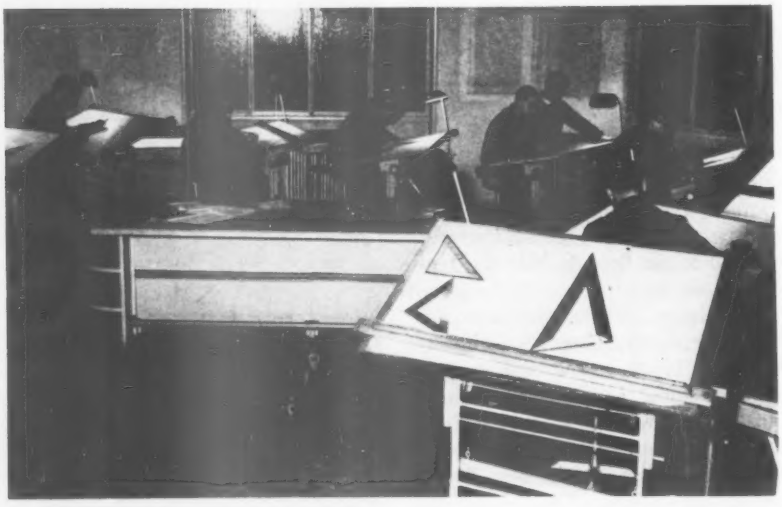
CLASSROOM, Superior School of Welding, a course given only to engineering graduates

French Institute

It trains weldors; it gives degrees in Welding Engineering; it conducts research; it publishes manuals and technical papers; it gives qualification tests and field inspections of work in progress. And it's paid for by private industry

BY ROB FOSTER
McGraw-Hill World News

QUALIFICATION tests for specialized trades such as pipe fitting are also taken at the Institute



DRAFTING ROOM, Superior School of Welding. The student takes design, electrical theory and circuits, metallurgy, physics, chemistry, material resistance, etc. Upon completion, he is given the degree of Welding Engineer

SHOP WORK is given to prospective weldors and welding engineers alike. A man who wants to train himself can also come in and use the equipment

te of Welding

LOCATED in an impressive building in Paris, the French Institute of Welding and Allied Techniques is an interesting organization in both theory and execution. It has no American counterpart and is the only organization of its kind in France dealing exclusively with welding.

WHAT IT DOES

The Institute trains weldors, offers welding instruction of all kinds, carries on research, acts as an official test laboratory for welding materials, acts in the capacity of impartial inspector of welding on the job, maintains its own documentation center and publishing house, serves as headquarters of the Society of Welding Engineers, the Society of Makers and Users of Welding Equipment and the Welding Standardization Committee.

There are two main sections: The Institute of Welding, which handles all of the educational programs, and the Central Office of Welding, dealing chiefly with the research and testing laboratories. The documentation center and periodicals come under a third and separate section.

The main educational program is the training of twelve- and thirteen-year-old boys who have had the equivalent of our grade school education. This school, called the School of Professional Welding, is made up of a group of practical and technical courses given over a period of three years. Instruction is given free as well as the materials and the use of the welding equipment; the student needs to supply only his own lunches. There are from 20 to 30 new students enrolled in this course each year, giving a total of around 80 in the program at one time.

The first year consists mainly of theoretical courses and basic educational needs such as design, the French language, geography, math and metallurgy. The next two years' lectures cover the technology of the different procedures of welding, descriptive geometry, industrial design, mechanics and electricity. Courses in metal work, tempering, forge work, all forms of welding, soldering and brazing, different types of metals and alloys, are conducted in the shop.

There is no specialization or real emphasis on welding during the first year. The second and third years are devoted to intensive welding training consisting of shop work and lecture courses. The welding technology lectures cover use of all types of welding equipment. Oral tests are given every week, and written tests at the end of each month. After the successful completion of three years, the student takes a special exam, theoretical and practical, under a group of teachers and an inspector of teaching technique. If he makes a special grade, he is given a Certificate of Professional Aptitude. When he enters industry from the Institute, the promotion to foreman and higher is usually very rapid.

COURSE FOR ENGINEERS

The other main educational program offered under the Institute of Welding is the Superior School of Welding, a one-year course offered only to young men who have already received their degrees in engineering. Upon completion, it gives the degree of Welding Engineer signed by the Minister of National Education. Though the shop work remains primarily the same as the School for Professional Welding, much more emphasis is placed on the theoretical side of welding. The student taking this program pays for his own training and takes metallurgy, chemistry, physics, design, material resistance, statics, electrical theory and circuits applied to welding. He also receives practical training in the shop.

About every three months, frequency ruled by the demand, the Institute offers a group of short two-week courses for engineers and technicians, who enter to learn exactly what to expect in the way of welding performance. The Institute caters to specialized industries, and each one of the two-week courses covers the application of welding to a particular field. The short courses run along the same technical line covered in the main ones, but go much more deeply into applications to the particular industry.

A similar course is offered for men who want to know what to expect from welding in general, and not welding in a particular industry. There are also initiation courses for workers who want rapid practical training but no specialization and a course in which the worker trains himself in the use of any or all of the welding equipment. In all of these courses, the price of instruction and materials is paid by the student or by his employer if he has

LIBRARY contains engineering and technical publications from all over the world. The more important welding articles are translated into French

been sent for specialized training.

The Institute is a non-profit foundation working toward the betterment of French welding standards. Money to support the various programs comes mainly from manufacturers interested in welding. All manufacturers in France are forced to pay an apprenticeship tax, which ordinarily goes to the government. A manufacturer, however, is permitted to donate a part of this tax as a gift to an accredited institution in which he is interested. The School of Professional Welding is almost entirely supported by these gifts. Manufacturers using a great deal of welding in their plants willingly give their apprentice tax money to an institution which is training better weldors for them. Other gifts come from plants making and selling welding equipment, who make frequent use of the Institute's laboratories and subscribe to the periodicals it publishes.

The Central Office of Welding at the Institute is the section handling all of the research and laboratory work. The Institute's laboratories are used both for testing materials and for research along new lines of development. Manufacturers dealing with welding equipment naturally take a great interest in these laboratories and contribute sizable gifts to keep them active. Beside the regular testing of equipment and research, the Institute will upon request make private tests for any individual or company at cost.

The Institute is usually engaged in some form of welding research and publishes the results, or one of the technical societies has the report published. Thus there is always a flow of material on welding. The Institute also acts as the official welding laboratory for the French National Conservatory of Arts and Crafts.

Publishes Periodicals

The documentation center, maintained by the Institute, uses money from the general fund for publishing expenses. Most of the periodicals carry some advertising, though not in an amount comparable to magazines in the U. S. The advertising, however, pays for the cost of printing above the amount covered by subscriptions. The names of the Institute's periodicals are: *Welding and Connected Techniques, Bulletin of Documentation of Welding and Connected Techniques,* both published by the Publications of Welding and Allied Techniques.

Also in the documentation center library is a card index on all welding processes. The library may be used by any interested person as long as the material is not on the restricted list. Technical journals from all over the world are on its shelves. The center's translating service takes interesting articles from other countries and translates them into French. The library is located in the main Institute building, while the publishing house is in a separate building on the other side of Paris.

The center also publishes welding manuals, which are in use all over France. The manuals are revised whenever there is a new method or equipment becomes out of date. Material discussed at welding society and engineering meetings, is published as pamphlets and distributed among interested people. Lectures and shop work are also printed and kept on the library shelves.

Tests and Inspection

The Institute is the only French organization authorized to award certificates of welding skill. All weldors of specialized trades such as bridge construction, aircraft, pipe and pressure work, etc., are required to have special certificates before doing any work in these fields. Before receiving a certificate, the weldor is required to pass a test covering the particular field in which he plans to work. In order to check against any lowering of the standard of work, he must retake the test every six months.

Special tests for the different trades and different types of welding are all taken at the Institute. The tests cover aircraft (alloys and special metals), pressure vessels and pipes (steam, gas, water, heating and refinery), ventilation, special metals (copper, brass, alloy steel) and are also divided as to the different types of welding equipment used (arc, resistance, oxyacetylene, atomic-hydrogen).

Another service offered by the Institute is the impartial inspection of welding on the job. The Institute provides this service for the protection of the general contractor and industrialist. By supervising the whole job from start to finish, it is possible to catch errors before they go into the actual construction. During the inspection, the contractor is investigated, all of the weldors are checked for skill, the materials used are tested, finally the finished project is checked over for faults. The Institute makes a gamma-ray inspection and also has a portable X-ray machine which may be taken to the site of the job. Some examples of jobs inspected: pipes for central heating in Paris, both steam and water, several petroleum cracking plants, bridges, large steel molds, tanks and cylinders for liquefied gases.

Photos courtesy of the Nelson Stud Welding Division of Morton-Gregory Corp.

SPRINKLER HANGERS were stud welded to floor beams in the 400,000 sq ft Perfection Stove Co. plant at Cleveland. Wiring throughout the plant is also supported by stud-welded hangers

WIRING HANGER, a prepunched angle, is on stud located just above gun. It will likewise fasten on the stud operator is now welding

Stud Welding at Stove Plant

Lighting fixtures, wiring and sprinkler pipe at the new Cleveland plant of The Perfection Stove Co. are upheld by threaded studs attached by means of the welding gun

BY W. R. BREWER
Field Engineer,
The George S. Rider Co.

STUD WELDING has proved an effective means of cost reduction in the installation of sprinkler lines, lighting and other electrical services at the new Cleveland assembly plant of The Perfection Stove Co. This two-story, 400,000-sq-ft structure was built by the George A. Rutherford Co., general contractor and designed by The George S. Rider Co.

The building has a structural steel frame with Robertson Q-flooring for the second story. Sprinkler lines, installed by the Automatic Sprinkler Corp., are suspended from special hanger rods stud-welded directly to the Q-panel. The accurate control of welds made possible by the automatic stud-welding gun enabled the connections to be welded to the 18-gauge steel without harming the panels. Since the welding flash was confined by ferrules, it was also possible to weld the studs in the presence of combustible materials. Hence there was no need to cover with fireproof materials the crated stoves or the wood block flooring in areas where work was under way.

Comparable savings were also reported by The Parker Electric Co., electrical subcontractor, which employed stud welding in the installation of fluorescent lighting, wiring and other electrical equipment. With the field wide open, Parker was quick to recognize that it would be more economical to weld threaded studs directly to the purlins and floor beams than to use bolted beam clamps or welded brackets. First, the studs were manually welded in a single bay, effecting an average of six per hour. This includes the time required for shifting scaffolds and blanketing the surrounding areas, but the welding itself required better than five minutes per stud. Adoption of the automatic stud-welding gun enabled Parker to install studs for the lighting hangers at an average rate of 20 per hour.

FIXTURES for fluorescent lighting are also supported by studs. Here a ⅜-in. threaded stud is being welded to one of the floor beams

All of the home-run wiring as well as the feeder lines for the lighting system and the special night-light circuit were secured to the structural steel by means of stud welding.

Electric Welding Conference

Arc and resistance welding problems from the electrical engineering standpoint were discussed at the AIEE-sponsored Detroit conference

BY CLYDE B. CLASON

DETROIT being the resistance welding capital of the United States, it was altogether fitting that the first AIEE conference on electric welding should take place in the motor city. The conference, staged at the Rackham Memorial Building on Dec. 6, 7 and 8, was a gathering of intellectuals at which hocum and horseplay were conspicuously absent. The 409 electrical engineers and welding experts attending came from all sections of the country in quest of information—and made sure that they got it by taking a lively interest in the discussion groups.

The conference was held under sponsorship of the Electric Welding Committee, American Institute of Electrical Engineers, in coöperation with the Michigan section of AIEE, the Detroit section of the American Welding Society and the Industrial Electrical Engineers' Society of Detroit. It was smoothly stage managed. Session chairmen were rather ruthless in holding speakers to limits of 12 to 15 minutes per paper, leaving an equal amount of time for discussion. Of the six sessions, two were devoted to arc welding and four to resistance welding, the latter including a session on plant distribution systems and another on problems of power supply. A total of 31 papers were presented as well as several written discussions.

Trip to Ford Plant

For relaxation there was provided an interesting inspection trip to the Ford Motor Co. at Dearborn. Taken on a guided tour through the press plant, the visiting engineers watched mammoth presses stamping out sheet metal for body parts and witnessed the subassembly of some of the stamped parts by portable welding guns and large multiple-electrode spot welders. The tour also included a trip down the final assembly line, 1,700 yards long, where new Fords took shape, at a rate of seemingly one a minute, from wheelless chassis to finished automobile.

Monday, the first day of the conference, was devoted to morning and afternoon sessions on arc welding. The opening session was called to order by E. H. Vedder, Westinghouse Electric Corp., Buffalo, the able chairman of the AIEE Electric Welding Committee.

The initial session, on the "fundamentals" of arc welding (as scientists understand fundamentals) was under chairmanship of Dr. R. C. McMaster, Battelle Memorial Institute, Columbus, O. Papers were given by: Dr. J. D. Cobine, General Electric Co., Schenectady; Dr. Lauriston P. Winsor, Rensselaer Polytechnic Institute, Troy, N. Y.; D. C. Martin, P. J. Rieppel and C. B. Voldrich, Battelle Memorial Institute; Dr. T. B. Jones, Johns Hopkins University, Baltimore; R. C. Freeman, General Electric Co., Fitchburg, Mass.

Dr. Cobine's paper presented a summary of the physical phenomena occurring in the short, high-pressure, heavy-current welding arc. Apparently much of what goes on there is still veiled in deep mystery. "Physicists steer clear of anything so horrible as the welding arc," Dr. Cobine interjected. "They shudder and go on to something more simple."

What *is* known is that the column of the arc burns in a gas mixed with metal vapor from the electrodes. The gas in the column is at a very high temperature, ranging from 5,000 K to 7,000 K (9,525-13,125 F). The voltage drop of the arc is equal to the ionization potential of the gas in which it burns. Some of these are: helium 24.5 volts, argon 15.7, nitrogen 14.5, oxygen 13.5, iron, copper 7.5, sodium 5.12.

At the cathode end of the column is an extremely important and poorly understood region known as the cathode drop region, where the cathode spot is located on the surface of the electrode. The cathode spot is the point of current transfer, and the cathode drop region is the space in which energy conditions are established to make that transfer possible. The how and why are still unsettled: the theory of electron emission is satisfactory only for tungsten and carbon rods.

Anode Spots

Further light on what occurs in the welding arc was shed by Dr. T. B. Jones, assistant professor of electrical engineering at Johns Hopkins, who described some interesting experiments with arcs moving at high speeds. A metal tape was wound spirally to cover the surface of a 6-in. pipe, which was then placed in a lathe and revolved. The tape was connected as the anode of the circuit and a carbon electrode on a straight-line traveling carriage as the cathode. Motion pictures showed plainly the formation on the tape of anode spots in which metal was melted and piled up in a peak as though from a vortical or whirlwind motion. Such spots were not found when the tape was connected as the cathode.

Other high-speed motion pictures of the arc, taken in color at the Brooklyn navy yard at a rate of 4,000 frames per second, were presented by Dr. Winsor. Clear indication was given of each current pulse and when the polarity changed.

Dr. Winsor's own paper was a preliminary report on instrumentation developed in an investigation of welding arc stability sponsored by the Bureau of Ships of the Navy Department. By means of this new equipment and a mechanical welding head, the performance of a number of different commercial electrodes of the same AWS classification was investigated and found to vary widely. The method involves the use of electronic circuits for determining root-mean-square values of the fluctuating com-

AT FORD ROTUNDA, 200 electrical engineers and welding experts begin their tour of the Rouge plant as part of the electric welding conference

ponents of arc current and voltage, and for counting short circuits. These circuits are supplemented by recording instruments for measuring the average values of arc current and voltage.

Burn-off characteristics of steel welding electrodes were surveyed in the Martin-Rieppel-Voldrich paper. Mr. Martin presented data to show that various types of bare and coated electrodes of the same wire diameter may differ in burn-off rate under the same welding conditions. A pronounced effect is also produced by changing the electrode connection from the negative to the positive side of the d-c welding circuit.

The session concluded with a brief discussion of welding equipment from the viewpoint of the users' needs by R. C. Freeman, of General Electric. Good equipment, said Mr. Freeman, should be functional in design and provide welding performance, a simple and accurate current control, ready portability, low maintenance and long life.

Inert-Arc Welding

The afternoon session on inert-atmosphere arc welding was under chairmanship of E. F. Steinert, Westinghouse Electric Corp., Buffalo, and included papers by H. T. Herbst, The Linde Air Products Co., Newark; E. H. Roper, Air Reduction Sales Co., Murray Hill, N. J.; A. U. Welch, General Electric Co., Holyoke, Mass.; G. O. Hoglund, Aluminum Co. of America, New Kensington, Pa.; R. D. Williams, P. L. Mirolo and C. B. Voldrich, Battelle Memorial Institute; and C. W. Frick, General Electric Co., Schenectady, N. Y.

Mr. Herbst covered the general fundamentals of the process with both non-consumable and consumable (metal-arc) electrodes. Mr. Roper and Mr. Welch discussed equipment, including new control devices.

Use of the inert-arc process in aluminum welding was the subject of two papers. That of the three researchers from Battelle, presented by R. D. Williams, pertained to the electrical problems encountered in welding aluminum plates ½ to 2½ in. thick. These problems were: magnitude of welding current (up to 900 amp), partial rectification of welding current (d-c component superimposed on the alternating current), stabilization of the arc, control of wire feeding, high open-circuit voltages. With mechanized welding, ¼ and ½ in. electrodes were used for the thick-section aluminum; with manual welding the upper limit was 5/16 in.

Mr. Hoglund considered aluminum welding from the standpoint of the user. He stressed that the higher costs of the process must be balanced by its advantages such as the elimination of flux, reduced finishing, etc., if use is to be worthwhile. Since gas is one of the principal cost items, it pays to take extra precautions not to waste it. (Valves for turning the inert gas on and off automatically were discussed by Mr. Welch. It is interesting to note that shutting off the gas too soon may cause sufficient oxidation of the tungsten to increase electrode consumption 20 times.)

Radio Interference

The timely and highly important question of radio interference caused by the high-frequency currents used for arc stabilization was allotted to C. W. Frick, general engineering and consulting laboratory, General Electric Co. Though the number of complaints has not been large, it is desirable, Mr. Frick believes, for the welding industry to put its own house in shape in order to avoid a forcible housecleaning by the Federal Communications Commission.

Briefly summarized, the apparatus circuit or some part of it, under certain conditions, acts like a radio antenna and transmits the disturbance by radiation. Means for minimizing the disturbances include use of the most favorable types of circuits, proper adjustments, etc., and also properly applied shielding and the effective placement of grounds. Precautions should be observed in the installation of filters.

Three-Phase Welding

A roundtable discussion on three-phase welding featured the first session on resistance welding, held Tuesday morning under the chairmanship of G. W. Garman, General Electric Co., Schenectady. Papers were presented by the representatives of four manufacturers: Thomson Electric Welder Co., Federal Machine and Welder Co., Sciaky Bros. and Taylor-Winfield Corp.

J. F. Deffenbaugh, Federal, and F. L. Brandt, Thomson, discussed the subject from the point-of-view of frequency conversion. Such a system was explained by Chairman Garman to consist of two rectifiers which pass current in turn successively through the primaries of a welding transformer, producing a so-called low-frequency current (12 cycles per second).

J. L. Solomon, Sciaky, differed in this interpretation of the welding machine as a frequency converter; to him the three-phase system, as developed by Sciaky, is a means of producing unidirectional pulses of secondary current varying in length from 1/60 to 1/3 seconds. "In many cases," says Solomon, "the complete welding job can be performed with a single unidirectional impulse, the next weld being effected by a second unidirectional impulse of opposite polarity; or, in the welding of heavier gauges, a series of these impulses may follow each other until the weld is formed."

All three authorities were substantially in agreement that the three-phase system provides a more balanced load, a better power factor and a gradual rise of welding current,

(*Continued on Page 84*)

Idle Welders

Needn't Cost Money

Startling possibilities for saving power and cutting d-c welding costs are found in the automatic start-stop control and arc-time totalizer, recent studies show

BY F. H. VARNEY
D-V Welding Controls, Oakland, Calif.

1—FOUR OUT OF FIVE welding machines assigned to the five men pictured in the above typical tank welding scene are running idle. The idle welders cost money—the big question is how much?

THOSE familiar with arc welding are aware that d-c welders run idle a considerable portion of the time. Is it feasible and is it worthwhile to shut them off instead of allowing them to run idle during periods when no welding is taking place? A number of considerations enter into the answer to this question.

How much running time can be eliminated?

How often will the welder have to start and stop?

What would the net effect be on electric power load (amperes), demand (kilowatts or kilovolt-amperes), energy consumption (kilowatthours) and power factor?

What would net effect be on overall maintenance costs?

Will there be any interference with normal arc welding techniques or with weld quality?

METHOD OF TEST

To help find the answers to these questions, the special instrument shown in Fig. 2 was developed. This instrument, when connected to an electric-driven d-c welder, registers:

(1) The total number of minutes that the welder ran.

(2) The number of minutes the welder would have run if it had been shut off each time there was a two-minute period of running idle.

(3) How many times the welder would have started and stopped if operated as described in (2) above.

(4) How many times the welder was actually started.

(5) The total number of minutes of arc time.

A number of instruments of this type were built, and tests were conducted in shops and plants of various sizes and in a variety of industries. In a typical test installation (see Fig. 2), the instrument was left connected to a welder for two days, then moved to other welders in the same plant for two or three days each. The selection of welders was usually made with the purpose of securing data representative of the average conditions for each type of welding operation, although in a few instances a deliberate attempt was made to select extremes. Readings were taken at the beginning and end of each shift in most cases, and were entered on the log sheet designed for this purpose (see Fig. 3).

An interesting psychological factor that came to light illustrates the need for caution in the use of data gathered by conventional time-study methods in which stop watches are used. Some of the tests made with the special instrument showed a relatively high arc time for the first day, followed by substantial decline in arc time during subsequent days as the operator became less concerned over the fact that a test was being run and the "test attitude" wore off.

How much running time can be eliminated?

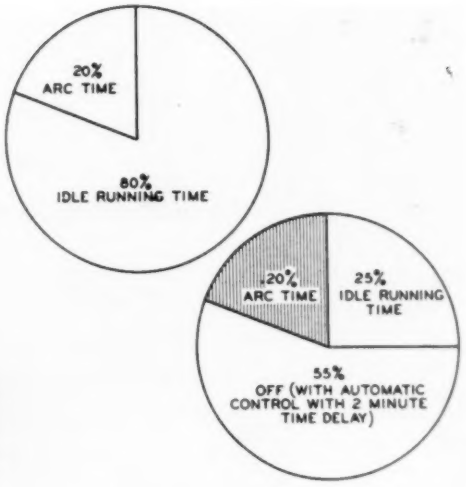
Answer: Usually about 55% (Fig. 4). The tests indicate that for most industrial welding the amount of running time that can be eliminated by shutting off the welder after two minutes of idle running falls in the range of 40 to 70%, with 55% as an average figure that could be applied in most instances with reasonable accuracy.

Even in operations which seemingly offered little or no opportunity for reduction of running time, the impartial instrument indicated that the welder could be kept shut off 30% of the time even when allowed to run idle for two minutes before being shut off. For example, a 30% reduction in running time was found possible in an efficiently run plant producing domestic hot water storage tanks on a conveyor belt.

How often will the welder have to start and stop?

Answer: About ten to twenty times per eight-hour day. Two minutes delay between cessation of welding and shut-off will usually make it possible for the operator to change electrodes, clean and inspect the weld and do the other numerous small tasks required of him without the welder shutting off. In rare instances, it was found that a delay of 2½ minutes further reduced the number of starts and stops. In other instances, it was found that the time delay could be shortened (in some cases to as little as 15 seconds) to

2—TEST INSTRUMENT mounted above welder registers the total running time, number of starts and stops, arc time, etc. Most of the tests were run two or three days on each machine, on various jobs



4—PIE CHARTS represent what happens to the 80% idle running time when welders are equipped with automatic shut-off control

effect a further reduction in running time of the welder.

Demand Also Reduced

What effect on power demand, consumption and power factor?

Answer: Since the type of automatic start-stop control under consideration keeps the welder shut off at times when it would otherwise be running idle, only the characteristics of the welder when running idle have bearing on the above question.

Conventional ammeters, wattmeters, watt-hour meters and voltmeters were used in a series of tests (Fig. 5) to determine the kind of load that the idle-running welder puts on its three-phase, 60-cycle power supply. A wide variation was found in the rate at which welders use power while running idle. The factors responsible for the variations are the output rating of the welder, the power supply voltage, the condition of the welder and the position of the d-c voltage control adjustment. For welders rated at 300 amp, values of idle running input were mostly in the range of 3.5 to 4.5 kw. For 400-amp-rated welders, the idle running inputs were usually in the range of 4 to 6 kw, with isolated instances running as high as 8.5 kw.

Power factors were usually in the range of 25 to 35%.

The effect on the power supply of using automatic start-stop controls to reduce by about 50% the running time of an average group of welders

User. [redacted] Address. [redacted] Set used for Stud bank production

Welding set: Make [redacted] Size 300 A volts 440 cycles 60 location Ext. Wing

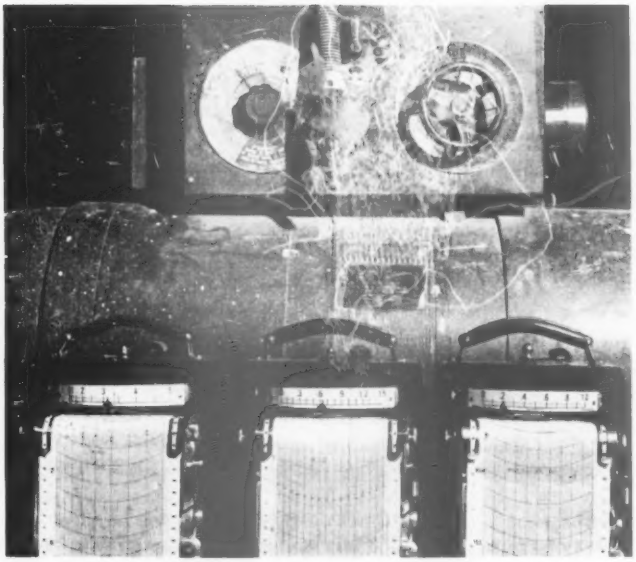
	1	2	3
Test run number			
Time and date, end of test run.	4:00 PM 7/24	12:30 AM 7/25	4:00 PM 7/25
Time and date, start of test run.	7:30 AM 7/24	4:00 PM 7/24	8:00 AM 7/25
Total elapsed time, in minutes (A)	480	480	480
Meter No. 1			
Meter reading at end of test run.	2514	3030	3522
Meter reading at start of test run.	2010	2514	3030
Difference (B)	504	516	492
Meter No. 2			
Meter reading at end of test run.	1937	2199	2398
Meter reading at start of test run.	1646	1937	2199
Difference (C)	291	262	199
B minus C (Min. running time saved)	213	254	293
Percent reduction in running time $\frac{(B-C)}{A}$	$\frac{213}{480}$ = 44%	$\frac{254}{480}$ = 53%	$\frac{293}{480}$ = 61%

Note: (B) equals actual running time of welding set, in minutes.
(C) equals number of min. welding set would have run if equipped with DW Control

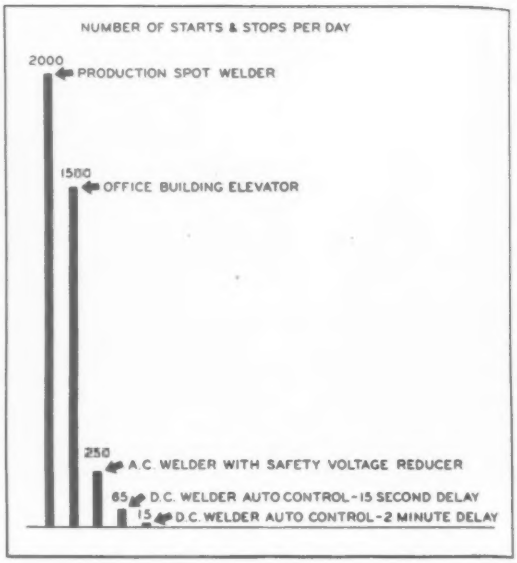
Meter No. 3			
Meter reading at end of test run.	0280	0296	0317
Meter reading at start of test run.	0266	0280	0296
No. of automatic starts-stops	14	16	21
Meter No. 4			
Meter reading at end of test run.	0117	0118	0120
Meter reading at start of test run.	0116	0117	0118
No. of manual starts-stops	1	1	2
Arc Time Meter			
Meter reading at end of test run.	1033	1139	1249
Meter reading at start of test run.	884	1033	1139
Arc time, minutes	149	106	110
Arc time, per cent of total time	31%	22%	23%

11/45

3—LOG SHEET for three test runs shows reductions in welder running time of 44, 53 and 61%—an average reduction of 53% of total time worked



5—METER READINGS on this idling welder are, left to right: 33 amp, 12.6 rkva and 4.4 kw. Respective multipliers for readings are 10, 20 and 20. The computed power factor is 35%



6—STARTS for d-c welder equipped with automatic controls set for 2-minute time delay are only 1/100th those of an office building elevator

was found to be approximately:

(1) Reduction in load at 220 volts, three-phase, 17 amp per welder.

(2) Reduction in demand (on which power bills are based), 2.5 kw per welder.

(3) Reduction in reactive kva, 7 rkva per welder.

(4) Reduction in energy consumption per month per eight-hour shift, 430 kwh per welder.

Starting up Again

A welder requires approximately one second for coming up to full speed from a standstill. The energy consumed during this period was measured and found to be approximately equal to the amount of energy which the same welder would consume while running idle for seven seconds. Taking into account the average number of starts and the reduction in welder running time that would result from the action of the automatic start-stop control, it was found that the added energy consumed during the starting periods is about 1% of the reduction in energy consumption due to elimination of needless idle running of the welder. Similarly, the tendency for increase in demand due to the start-up is only about 1% of the decrease in demand resulting from the action of the automatic start-stop control in keeping about half of the welders shut off. And the load added to the electrical circuits is only about 1% of the reduction achieved by eliminating the idle running.

Almost without exception, the reduction in the power bill has proved to be sufficient to exceed the full cost of the automatic control equipment in the first year of use. Each public utility has its own set of power rate schedules, so it is not possible to state exactly what the effect on the power bill will be.

Welders Last Longer

What net effect on overall maintenance costs?

Answer: Cutting the running time of a group of welders in half is sure to result in a major reduction in wear and consequent reduction in the amount of maintenance work and deterioration of the equipment. Because of the two-minute delay between cessation of welding and shutdown, the number of extra starts and stops is so small (see Fig. 6) that no noticeable increase in wear of the magnetic contactor of the welder need be considered.

The added maintenance of the automatic start-stop control itself has proved to be a minor factor, provided that the control equipment is of simple, rugged design and almost free of moving parts (Fig. 7).

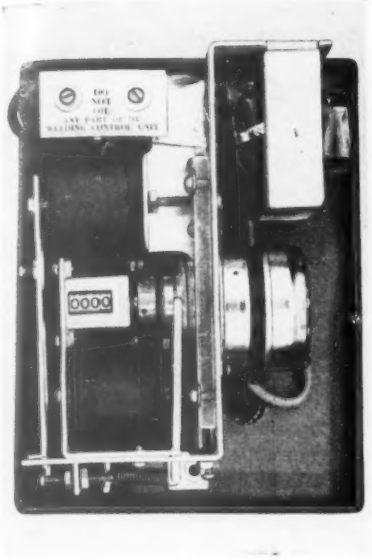
Any interference with welding technique or quality of weld?

Answer: There can be no interference with welding technique since the operator does exactly what he would do if his welder were not equipped with the automatic start-stop control and were left running continuously, night and day. When he is ready to weld, he merely touches the electrode to the workpiece to draw an arc. The contact made by the electrode causes the automatic control to start the welder instantly. There are no extra wires running to the electrode holder and no buttons to push. The only difference is that the operator does not have to leave his work, either to start or to stop the welder.

The automatic control starts the welder so quickly that there is no possible way to weld at the incorrect values of welding current or voltage existing during the starting period. No other aspect of the automatic start-stop control can have any effect upon weld quality.

Arc-Time Totalizers

If desired, an arc-time totalizer can readily be incorporated as a part of the automatic start-stop control (Fig. 7). When so included it costs but a fraction of what a separate arc-time totalizer would cost. Another rather important advantage to including the totalizers as a part of the



7—CONTROL with arc-time totalizer (left, center). Cover has been removed to show construction

Machine No.	4800 Working Minutes March 22	April 5	Diff. 3/22 to 4/5	4800 Working Minutes April 16	Diff. 4/5 to 4/16	7200 Working Minutes May 9	Diff. 4/16 to 5/9
1	0000	0317	317	1515	1198	4139	2624
2	0000	0288	288	1017	729	1354	337
3	—	0121	—	1117	996	3935	2818
4	0000	0349	349	1832	1483	6399	4567
5	—	0212	—	1245	1033	3555	2310
6	—	0092	—	0916	824	1867	951
7	—	0168	—	1143	975	4182	3039
8	—	0102	—	1476	1474	2789	1313
9	—	0180	—	1191	1011	3192	2001
10	—	0008	—	1103	1095	2890	1787
11	—	0061	—	0655	594	2719	2094
12	—	0054	—	0612	558	2223	1611
13	—	0002	—	0642	640	2139	1497
14	0000	0239	239	1697	1458	3954	2257
15	0000	0299	299	1009	710	2619	1610
16	—	0061	—	0823	762	1799	976
17	0000	0297	297	1950	1653	3167	1217
18	0000	0238	238	0581	343	2072	1491
19	0000	0278	278	0645	367	3388	2743
20	0000	0351	351	1833	1482	4221	2388
21	—	0170	—	0675	505	1519	844
22	—	0001	—	0089	88	0611	522
23	—	0122	—	0605	484	0949	343
24	—	0023	—	0763	740	0788	25
25	—	0007	—	1001	994	2067	1066
26	—	0003	—	0960	957	2252	1292
27	—	0010	—	0670	660	2579	1909
28	—	0111	—	1600	1459	1670	70
29	0000	0742	742	0900	158	5867	4967
Total minutes arc time			3398		25430		50699
Percent arc time			11%		18%		23%
Period Covered			2 weeks		2 weeks		3 weeks
No. of welders for which arc time was averaged			10		29		29

8—ARC-TIME meter readings as tabulated for a West Coast plant fabricating steel tanks and heat exchangers. Arc time increased from 11 to 23%

start-stop control is psychological: attachment of a device which serves no purpose other than to register welding time is likely to offend or worry the operator because of his ignorance of the purpose to which arc-time data are put. When the totalizer is just an incidental part of a control, he is not so likely to jump to wrong conclusions concerning it.

Three methods have been used in the past to gather quantitative data on the welding operations: the footage welded, the pounds of electrodes consumed and the stop watch. The arc-time totalizer has advantages in convenience and accuracy over all of these, and it lends itself to continuous rather than spot checking.

It will be recognized that the totalizer registers the welding time for the machine rather than the man. Arc-time data averaged over a period of time or for a group of welders are of greater value and significance than information on how much arc time a particular individual ran up in a few working hours.

It is almost impossible to anticipate the uses to which arc-time data can be put in any individual plant. This point can be illustrated by citing a few cases:

Three More Pieces per Man

Two operators were each producing 33 pieces per day. It was wrongly assumed that they were running up the same arc time each day. The arc-time totalizer brought to light the unexpected fact that one operator's arc time was running considerably less than the other's. Further investigation revealed that the operator with the higher arc time had been consistently overwelding his pieces; however, he had also devised a faster, easier way for loading the piece into the fixture. When both operators used the easier way of loading the fixture and both did the proper amount of welding, the output increased to 36 pieces per day per man.

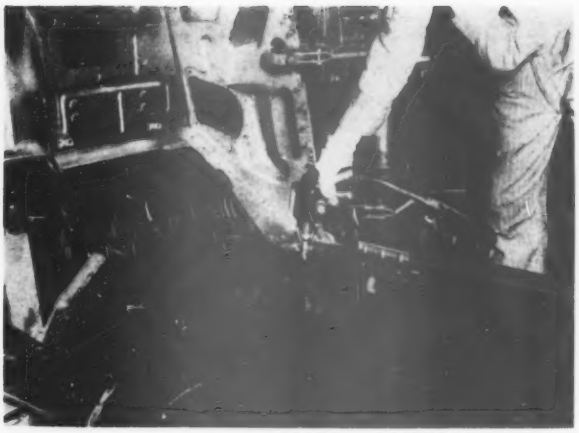
The dollar value of this increase in production was determined from the amount of the increase, (36—33) ÷ 33 = 0.091 = 9.1%, the hourly wage ($1.65) and the number of hours worked per month (173). It was found to be $0.91 \times 1.65 \times 173 = \$25.98$ per month per welder or per control. The added cost of the arc-time totalizer was only a fraction of this monthly gain. The saving in electrodes, though sizable, was not accurately measured.

In the above case, the quality of the weld was of minor importance, but there are many welding operations in which the strength and quality of the weld are paramount. By establishing the optimum arc time for a particular operation, subsequent records of arc time for the operation can be used as a means for quality control.

Another, even more spectacular, instance of the potential value of the arc-time totalizer is illustrated by the series of totalizer readings tabulated in Fig. 8. These are actual readings taken in a West Coast plant fabricating steel tanks and heat exchangers. The average arc time for ten out of the group of 29 welders was 11% during the initial period of use of the totalizers. The average arc time for the next two weeks rose to 18%, and for the three weeks following to 23%. Using 11% as an index of the initial production rate, and 23% as the final rate, the increase is measured by (23—11) ÷ 11 = 1.09 or 109%. Production more than doubled!

The dollar value of the 109% increase was estimated at $311 per month per welder, when figured without any allowance for overhead and on a one-shift basis.

Of the several factors contributing to the increase, not the least was the psychological value of the arc-time totalizer.



1—SPOT WELDING front door post assembly to the floor pan in framing jig of an auto body assembly line. Previously, metal-arc plug welds had to be made

2—BODY BRACKETS spot welded to floor pan. Cup of gun is placed halfway over edge of the 0.064-in. bracket to produce a weld similar to a gas-weld tack

Spot Welding with Inert Gas*

BY FRANK J. PILIA

Development Engineer, The Linde Air Products Co.

A new process makes use of the inert-gas-shielded arc to produce spot welds without back-up. It offers important advantages where access can be secured from only one side

A RESISTANCE spot weld is produced by the effect of high current and pressure applied to electrodes, while a gas-shielded spot weld is produced with fusion alone. The weld is produced by the heat from an arc applied to the top surface of two lapped pieces of metal. Since no forging pressure is required on the fused nugget, no back-up nor access to the reverse side is necessary—one of the major advantages of the process.

The welding action is controlled by the current input and by the time the arc is allowed to dwell upon the material being welded. The arc, tungsten electrode and fluid puddle are shielded with argon in a manner similar to conventional inert-gas-shielded arc welding.

Gun and Equipment

A welding gun about the size of a Colt 45 automatic performs the actual weld. The gun is of molded plastic and is fitted with a water-cooled copper cup in which a tungsten electrode is centrally located. The electrode is spaced back from the end of the cup by approximately 3/32 in., the setting varying with the materials being welded.

Other apparatus required consists of a standard 60-cycle a-c metal-arc welding transformer with a built-in high-frequency unit and, preferably, power-factor correction. A timing device using either a mechanical clock or electronic timer is employed. Longer time cycles are required than in resistance welding, and instead of the circuits for "squeeze" and "hold" times there is a circuit for argon shut-off delay.

All in One Hose

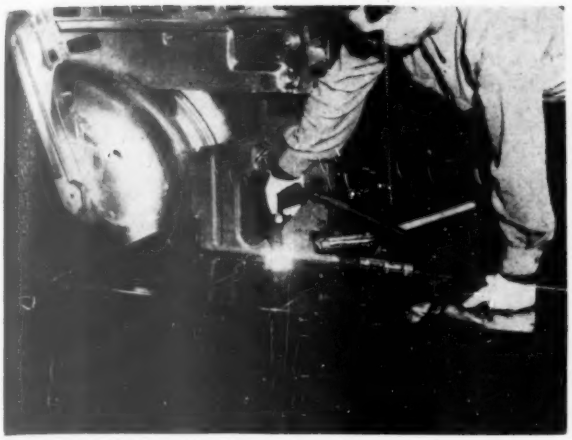
The argon is distributed through a series of orifices in the electrode-holding mechanism and is allowed to flow smoothly through the interior of the cup. Four V-shaped notches at the base of the cup allow it to be purged of the gases contaminated by welding. The cup is completely insulated from the current-carrying members.

Three hoses and a switch cord, all encased in one rubber jacket approximately 25 ft long, supply welding current, cooling water, argon gas and trigger control. This cable assembly is both flexible and rugged, being capable of withstanding considerable abrasion and rough handling on shop floors.

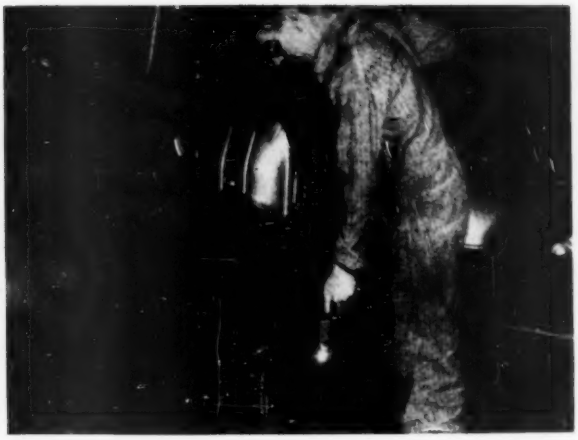
In a typical cycle of operation, the cup of the gun is brought to bear against the top of two lapped pieces. The trigger is depressed momentarily, closing the main contactor on the power supply to the welding transformer. As the primary contactor closes, the argon solenoid valve in the timing device opens to allow flow of argon to the cup. The high-frequency current superimposed upon the welding circuit ionizes a path between the electrode and the workpiece, allowing the 60-cycle welding current to initiate the arc.

When welding current begins to flow, a relay in the circuit closes to initiate the preset timing cycle. At the end of the correct time interval, the primary contactor on the welding transformer opens and extinguishes the arc. A second timer then continues the flow of argon to allow the electrode to cool in an argon atmosphere. The cooling time is usually

*Abstract of paper presented at the annual AWS meeting, Philadelphia, Oct. 24-29, 1948.

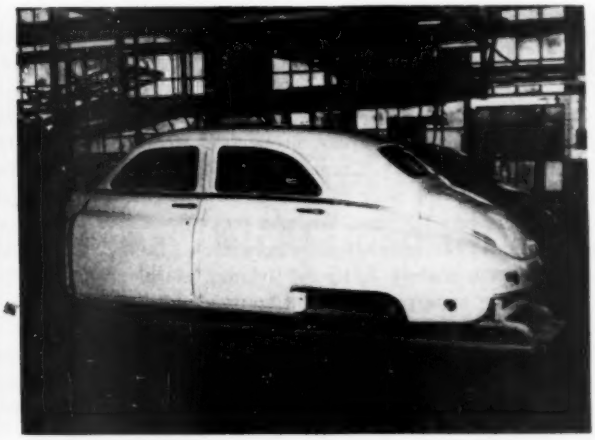


3—SIDE PANEL assembly joined to floor pan. Note compact hose assembly—a single rubber jacket carries the welding current, water, gas and switch control



4—ALONG DOOR SILL, reinforcing gas-shielded spots insure resistance spots against failure. The reinforcing welds were previously made by the metal-arc process

5—WINDSHIELD FRAME is added to front assembly. These welds, subsequently covered with body solder, are sufficiently flat as-welded to require no grinding



6—COMPLETED CAR BODY ready for shipment to the assembly plant. Body is made more quickly and made at lower cost because of inert-gas-shielded spot welding

10 to 15 seconds for a ⅛-in. tungsten electrode. The welding cycle cannot be repeated until the trigger has been released, and the arc has been extinguished. This precaution prevents unintentional refiring or time cycles longer than those preset.

Application to Auto Bodies

The automobile body is designed primarily around the resistance spot welding process, yet resistance spot welding is not always feasible because of obstruction of the work or inability to reach the opposite side for back-up. In such cases, the inert-gas-shielded arc spot welding process can substitute for metal-arc welding. Although either process can be used on locations where no back-up is available, inert-gas-shielded spot welding is faster, easier and requires no particular skill nor training. By comparison, a single gas-shielded spot weld in 0.037-in. deep-drawing mild steel produces the same mechanical properties as a metal-arc weld ¾-in. long or an oxyacetylene weld ½-in. long.

This process is particularly advantageous in the framing jig on assembly lines. In relatively inaccesible spots, the number of spots produced per hour can be greater than that produced with the cumbersome special spot-welding units now required to reach such places.

An application which is particularly suited to the process is the production of spots to be subsequently covered with body solder. With metal-arc welding on this type of joint design, it has been necessary to grind the weld flush or below the intended surface of the solder fill. The welds produced by the gas-shielded arc spot welding process are relatively flat, and the grinding operation is eliminated.

The accompanying illustrations show the application of the process to automobile body fabrication. These photos are made available through the courtesy of the Briggs Manufacturing Co. and show steps in the fabrication of 1948 models of a well-known car.

Fig. 1 shows the welding of the front door post assembly to the floor

pan in the framing jig. These welds were previously made by metal-arc plug welding. Resistance welding was not considered practicable because of the size of the welding unit that would be required to reach around the body sections involved.

Body brackets are welded to the floor pan shown in Fig. 2. The bracket is made of 0.061-in. material. In this particular operation, the weld is being made on the edge of the bracket to produce a weld similar to a gas-weld tack. The body is on a wheeled dolly and proceeds down the line during the welding.

Side Panel to Floor Pan

The welding of a side panel assembly to the floor pan in the framing fixture is shown in Fig. 3. Two gas-shielded spot welds are made on this flange in the fixture, and the balance of the welds are made after the body is removed from the fixture and is proceeding down the line. A few carefully selected spots, properly located during body framing, eliminate much of the poor fit-up usually encountered on the line. Without the welds, this particular flange would open approximately 3/16 to ¼ in. upon being removed from the framing jig. Two welds on each flange completely eliminate the separation.

The process may be used for reinforcement of resistance welds. Approximately four welds are spaced along the door sill joint shown in Fig. 4. These reinforcing welds were previously made by metal-arc.

Fig. 5 shows the use of the process to replace metal-arc tack welds. These welds join the windshield frame to the rest of the front assembly. They are subsequently covered with body solder and so must be flush or slightly lower than the surrounding surface. When metal-arc welding was used, the welds required grinding to remove the excess weld metal. With gas-shielded spot welding, no grinding is necessary.

An interesting application is the joining of side panels to the front assembly in the framing jig. Resistance welding could not be used on this joint because its reverse side was inaccessible. Due to the extremely different section thicknesses—0.037 to 0.090 in.—gas welding was too slow to keep up with the fixture. The metal arc could not be used on the framing fixtures because of flash, smoke and spatter. When inert-gas-shielded arc spot welding was adopted, a 70% reduction in door fitting time was achieved. The welds prevent the distortion of the door frame when the body is lifted from the framing jig.

The completed body is shown in Fig. 6. This body is made better, more quickly and at lower cost because of the use of inert-gas-shielded spot welding.

Liners for Pressure Vessels

In addition to automotive operations, the process has been successfully used in attaching light sections to very heavy sections. It is entirely possible to attach 0.040-in. sheet to a section 4-in. thick in various metals. Because of this, the process is practicable for applying stainless-steel liners to mild-steel pressure vessels. The surface of the mild steel should be free from mill scale, rust or dirt, and the liner must contact the mild steel in the vicinity of the weld during the welding operation. Welds can be made in flat, vertical or overhead positions.

Inert-gas-shielded spot welds in stainless steel have the same corrosion resistance as inert-gas-shielded continuous welds. In materials subject to carbide precipitation, the zone of precipitation around the weld will be extremely narrow due to the quenching effect of the heavier mass behind the weld. Weld time and current cycles can be set up so that very little dilution of the stainless steel liner by the mild-steel back-up occurs. The dilution, in fact, can be restricted to the area of juncture between the mild and stainless steel.

The process can be used satisfactorily to attach the top sheet to a corrugated sandwich such as is used in the manufacture of trailers and railway equipment. A corrugated sandwich is made by resistance welding the tops of the corrugated sheet to one of the side sheets. Because of the inaccessibility of the reverse side of the corrugation, resistance welding is impracticable for attaching the final side sheet. Gas-shielded arc spot welding has been used on these operations with very satisfactory results. Sandwiches have been made employing as many as 700 welds for the final assembly.

Metal furniture and cabinets can be easily fabricated by this process. Manufacturers of such widely diversified objects as outdoor display signs, home appliances and food handling equipment should find wide use for it. Mild steel and stainless steel in thicknesses up to 0.078 in. are being successfully welded in production.

Welding Aluminum

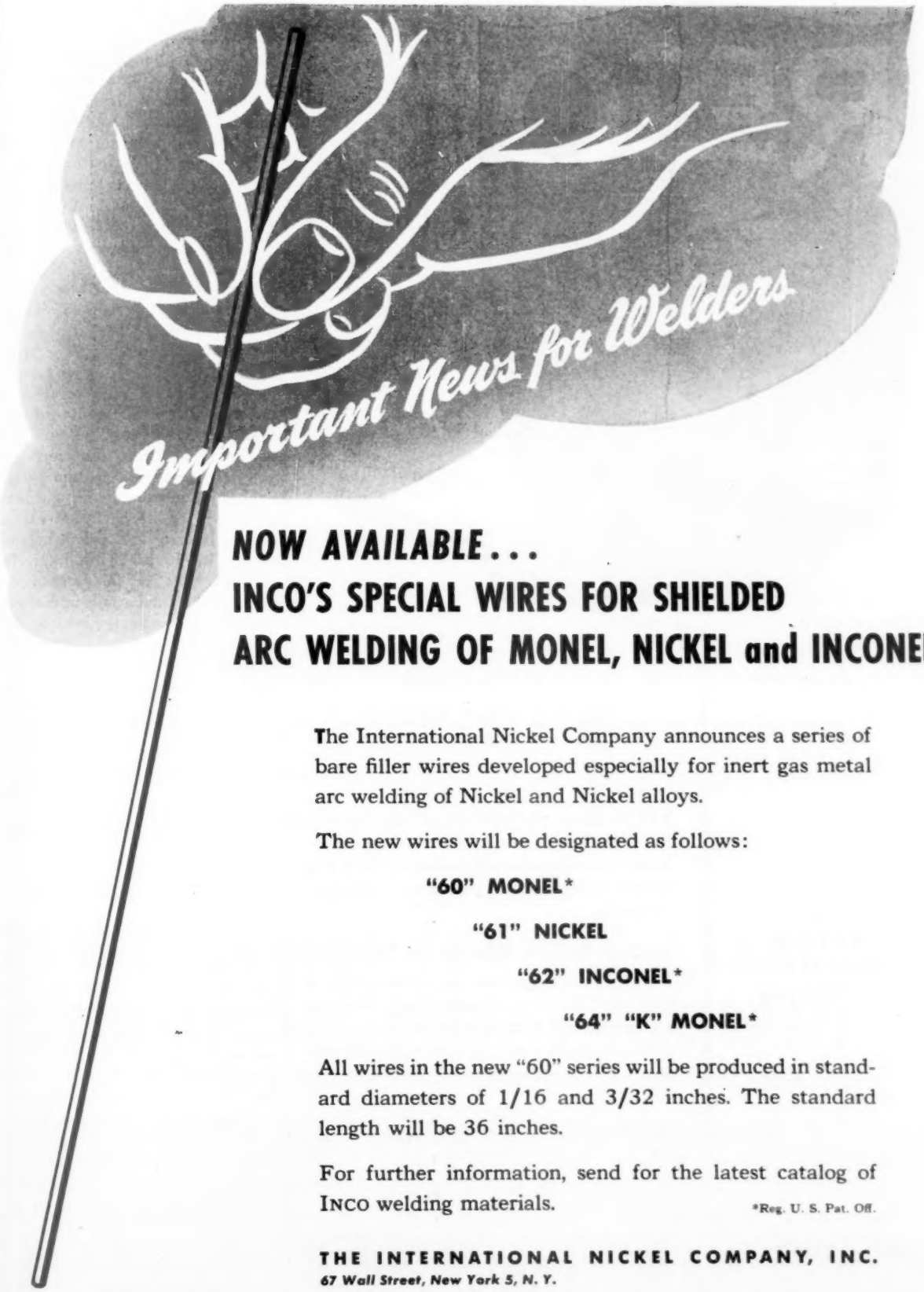
Aluminum materials up to 0.061 in. thick can also be welded with the same speed and satisfactory results. Welding conditions for aluminum are, however, somewhat different from those of mild steel and stainless steel. Due to the conductivity of aluminum, it is necessary that the sheets be in very intimate contact. To obtain the required fit-up, some means must be employed to back the reverse side of the weld. In the case of large structures, this may be done by a bucking bar held by a helper. Where smaller objects are made on a production basis, blocks can be located in a fixture to back the weld.

One rather unique feature is that it is possible to control the current and time settings so that welds can be made without disturbance to the reverse side of the sheet being welded. As an example, it was possible to produce five spot welds on an aluminum refrigerator vegetable bin assembly, reverse side of which was to be painted with a high gloss enamel. When resistance spot welding was used, considerable finishing of the aluminum was required in order to remove all evidence of the spot welds. Inert-gas-shielded arc spot welding did away with this finishing operation.

Surface conditions of aluminum materials require special attention. Oxides, carbonaceous materials and surface dirt must be entirely removed before welding. Chemical cleaning, vapor blasting or scratch brushing will produce satisfactory surfaces.

Weld Properties

Depending upon the material thickness, welding conditions and rapidity of operation, cost per spot ranges between 1 to 4 mills; welding times around ½ to 6 seconds per spot. Rejects due to weld failures average about 1½%. Malformed welds due to electrode contamination with the weld puddle and burn-throughs due to sheet separation and extremes in



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power-factor variation average 4.2% rejects. For various thicknesses of mild steel and stainless steel, spot welds made by the inert-gas process were compared with those made by standard resistance welding. The direct tension static samples of the inert-gas spot welds had lower values than the resistance spot welds. In all other kinds of tests, however, they very closely approximated the generally accepted resistance spot-welding values.

Inert-gas-shielded arc spot welding has several inherent advantages which make the process ideally suited for production welding. The ability to join two pieces of metal in the lapped condition from one side of the sheet only is one of its outstanding features. The extreme portability of the apparatus is also worth noting. The gas-shielded gun weighs only 2 lb, and the cables and hoses necessary for its operation are encased within a hose sheath approximately 1 1/16 in. in diameter. The welding cable in this assembly is only 10,000 circular mils in diameter. The total assembly is about as light and flexible as a piece of 4/0 welding cable. Resistance spot-welding guns may weigh upwards of 40 lb and have two welding cables of several hundred thousand circular mils to carry the 5,000 to 10,000 amperes required to make a weld. The length of cable on the inert-gas spot welding gun is 25 ft as compared to a maximum of 8 ft on a resistance welding gun.

Will Win Its Own Place

The inert-gas-shielded arc spot welding process does not and is not intended to compete with resistance spot welding. Due to the cost of the shielding gas and the longer time cycles involved, such competition is impracticable. What the new process does do is to fill the very conspicuous gap existing between resistance welding and fusion welding. In many applications, the inert-gas-shielded spot welding process replaces the fusion welding processes because of its lower cost.

Inert-gas-shielded arc spot welding is a new process and a new tool for the metal-working industry. It should develop into as important a process as resistance welding, metal-arc welding, oxyacetylene welding and other generally accepted welding processes.

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IOMA Meeting

Independent Oxygen Manufacturers' Association held its winter meeting at the Palmer House, Chicago, Dec. 6 and 7. Talks were on a variety of subjects, ranging from turkeys to steel mills

SERIOUS business was the object of the two-day winter meeting of the Independent Oxygen Manufacturers' Association, held in Chicago on December 6 and 7. IOMA is a group composed of the major independent oxygen manufacturers of North America. The Palmer House was the center of the association's activities, which included technical discussions, two luncheons and the annual banquet. Members and guests, it should be noted, came from such far-distant cities as Honolulu and Monterey, Mexico, as well as from all parts of the United States.

Harrison Bird, president, Bird Gas Corp., Detroit, and president of IOMA, opened the meeting at 10:00 a. m., December 6, with an address in which he welcomed the members present and outlined the current problems of the oxygen industry. Mr. Bird also indicated some of the association's plans to promote greater use of oxygen in all industry. At this point, Charles L. Steele, president, Steele Gases, Chicago, was introduced as a new member. There followed the report of the secretary, O. M. Randel, Independent Engineering Co., O'Fallon, Ill., and the treasurer's report by R. B. Swope, Jr., Southern Oxygen Co., Washington.

The Technical Sessions

The formal technical portion of the association activities began with a presentation by T. B. Jefferson, editor, THE WELDING ENGINEER, entitled "What Welding Means to America." Mr. Jefferson emphasized the need for an adequate educational job to acquaint the general public with welding. "Too few people realize the important role welding played during the war years or its importance in our everyday activities now," said Mr. Jefferson. "Had it not been for welding there would not have been adequate ships, planes or tanks to serve our troops during the war, nor is it likely that there would now be atomic bombs, high-octane gasoline or safe modern automobiles." He pointed out that the people who lack knowledge of the important part welding is playing today will never learn unless an adequate educational program is conducted by all those interested.

Mr. Jefferson also discussed the highlights of a recent survey THE WELDING ENGINEER conducted among 10,495 plants in the metals industry. The findings of this survey represent the first accurate and conclusive information as to the extent welding is used in some 56 branches of the metals industries.

Veterinary Oxygen

"Chickens and Turkeys in the Oxygen Industry" was the subject of an interesting presentation by R. D. Allison, vice-president and general manager, Denver Oxygen Co., Denver, Colo. Turkey raisers, he said, are increasing profits by raising their turkeys in an oxygen-enriched atmosphere. The mortality rate of growing turkeys has been materially reduced by this treatment. This opens a new field to the oxygen producer, which might, perhaps, fall into the category of medical oxygen.

John R. Brandt, vice-president of the Indiana Oxygen Co., Indianapolis, spoke on "What's Cooking in Italy." He not only included Italy but took in all of Europe. Mr. Brandt's remarks were based on his travels through Europe during the past summer and illustrated with photographs. "We are making a mistake," he declared, "by sending food and clothing instead of tools so that the people may be in a position to produce their own food and clothing. They want to work but do not have the tools with which to do it. Care, of course, must be exercised to insure that such tools are not used for war production."

James E. Norcross, sales manager, Arcos Corp., Philadelphia, described the oxy-arc cutting method, which combines an electric arc with oxygen to cut hard-to-oxidize materials such as stainless steel and cast iron.

The final paper of the first day was by D. M. Horner, vice-president of Harrisburg Steel Corp., Harrisburg, Pa. Mr. Horner told of the manner in which oxygen cylinders were manufactured and of their many uses. He also discussed the possibilities of further federal regulations concerning oxygen cylinders.

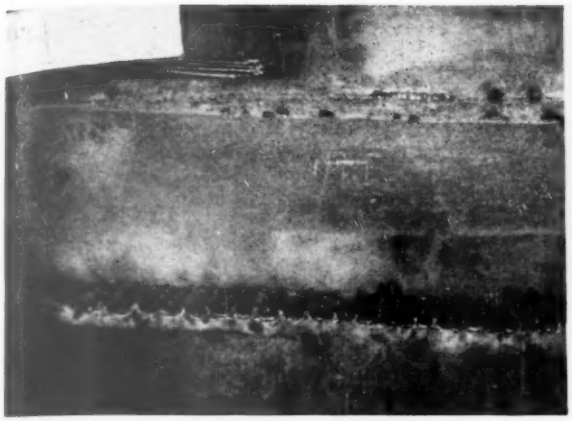
The annual dinner of the winter meeting followed a cocktail party on the evening of Dec. 6. After dinner, members and guests were entertained by moving pictures of the 1947 winter convention, which was held in Mexico City and Acapulco. The films were those taken by Paul Engler, president, Balbach Co., Omaha, Neb., and by President Bird.

Research Program

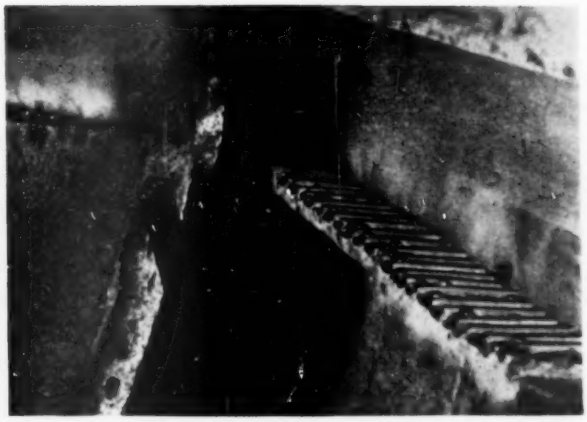
Mr. Engler opened the second day's meeting discussing, "The Need of a Paid Secretary." He was followed by Al Herzstein, Houston Oxygen Co., Houston, Tex., who talked on the subject, "Shall We Continue Our Research Program." Mr. Herzstein pointed out that much of the progress made in the use of oxygen has come about through continued research. Such a program should be of a long-range nature so that the members might profit to the greatest extent.

Use of oxygen in steel mills was the subject of two papers: "Tonnage Oxygen" by I. F. Fausek, Independent Engineering Co., O'Fallon, Ill., and "Use of Tonnage Oxygen" by J. F. Wagner, vice-president, Burdett Oxygen Co., Cleveland. Both speakers indicated that there is much to be learned before oxygen can be used as extensively in the open-hearth furnaces of steel mills as oxygen manufacturers would like to see.

The remaining time of the second day of the meeting was devoted to business activities of the association and future convention programs. It was decided that the annual summer meeting would be held in July at Murray Bay, Quebec. It was the consensus of opinion by those present, who represented over two thirds of the members of the association, that much had been gained in the two-day Chicago meeting.

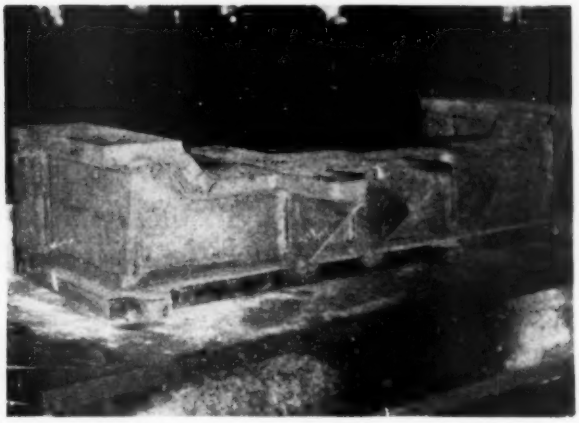


1—APPLICATOR BARS of different sizes saved weld metal, reduced shrinkage in repair of this casting



2—ALIGNMENT of the two halves of the casting enabled two weldors to work on both sides at the same time

3—ENGINE BEDPLATE was removed from bucket hoist



4—REDESIGNED BEDPLATE fabricated from plate

Big Jobs in Plant Maintenance

BELL support housing slide for the top of a blast furnace at the American Steel and Wire Co., Duluth, Minn., had suffered from the extensive wear which had taken place in the past ten years. Plant engineers, working in coöperation with welding engineers from The Lincoln Electric Co., figured out a method of welded repair. The worn area was first cleaned with a wire brush. Studs were then placed on 3-in. centers and cut to give the weldors a guide to the desired height. The initial step in the build-up consisted of two passes from an electrode producing machinable welds in cast iron.

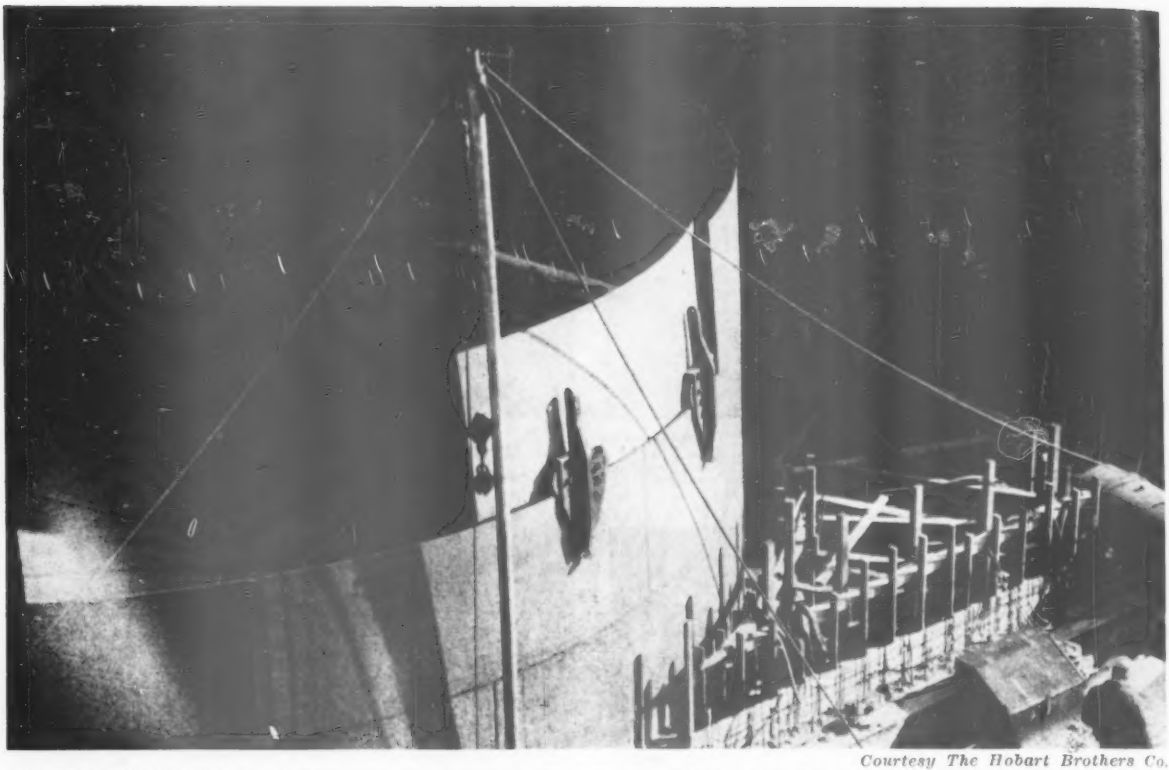
Next, mild-steel applicator bars, of different sizes but all of the desired height, were placed along the worn edge as shown in Fig. 1. These bars reduced shrinkage to a minimum and saved weld metal. The areas between them were built up with AWS E-6012 electrodes, and the surface was ground to the specified height.

The two halves of this casting were positioned as shown in Fig. 2, enabling the weldors to work almost simultaneously on both parts. To keep the gray-iron casting at constant temperatures, a kerosene torch was utilized.

Other interesting maintenance repairs were also engineered at the Duluth steel mill. The original gray-iron skip engine bedplate (Fig. 3) was pulled out of operation and redesigned for welded fabrication from 1½-in. hot-rolled steel plates. The redesigned bedplate is pictured in Fig. 4.

An all-welded die for punching out fence post hanger plates was also designed and fabricated from steel plate. The cutting edges of the die were built up with tool-steel electrodes. Final steps in completing the assembly were to stress relieve, machine and grind to dimensions.

The last job engaged upon was to refit the scored wall of a 42-in. ID cylinder from a blast furnace engine. The score was thoroughly cleaned, and the cylinder wall overlaid with deposits from ⅛-in. electrodes for cast-iron welding. The cylinder was then bored out and fitted with oversized pistons.



Courtesy The Hobart Brothers Co.

UPPER SHELL PLATE is hoisted to the "buggies," two grooved wheels that ride the top edge of the strake below

Build Tanks with Plate Buggies

By using "plate buggies" that are fabricated in its own shop
The Crown Tank Co. has reduced the cost of tank construction

BY MAX ALTH

THE "plate buggies" illustrated were designed and built by Paul Neal, of The Crown Tank Co., Bronx, N. Y., for tank-erecting jobs in which space doesn't permit the use of a crane. The tank in the picture, a giant 250,000-gal steel sugar bowl, is one of a number of syrup storage tanks built for the Refined Syrups and Sugars Co., Yonkers, N. Y.

The buggies consist, essentially, of two grooved wheels so placed that they ride the top edge of a ring or strake of side wall plate. The wheels are held by plate formed into a deep U that curves around the wall plate. The U has a small wheel on each end to keep it centered and reduce friction. A small step on the inside of the buggy holds the plate to be positioned; on the outside there is an upright arm to hold the plate erect for welding.

The first shell strake is welded to the floor of the tank, and then the second shell strake is hoisted plate by plate to the buggies and rolled by hand to its proper place.

A simple gin pole may be erected to raise the plates to the proper height. It works this way:

The first plate of the second strake, for example, is lifted by means of the gin pole and a hoisting engine to the buggies. Plate is then unfastened from the tackle and rolled on the buggies to the opposite side, where it is tack welded into place. Then the second plate is hoisted onto the buggies and rolled around so that it butts the first plate. Buggy nearest the first plate is rolled slightly back towards the center of second plate. This allows the second plate to fall into position for tack welding to the first plate. Then one buggy is removed from beneath the plate, and the other buggy is moved clear to the far end. This allows the plate to drop into position for tack welding the bottom. The plate is then butt welded to the adjoining plates, and the buggies are returned to the position below the gin pole to receive another plate.

The gin pole effects a considerable saving in operation cost over a crane, and it is also much easier to align a plate on buggies than it is to align a plate dangling from a cable.

The tank pictured is constructed of butt-welded $\frac{3}{8}$-in. curved steel plates. A single pillar in the center of the tank supports the top by means of channels extending spoke-fashion to the sides. The job took about four weeks to complete, with a crew of from three to seven men working a 40-hour week.

Estimating Roots and Powers

BY W. F. SCHAPHORST, M. E.

WELDING engineers are sometimes up against the problem of extracting an odd root or raising a number to an unusual power. The chart shown at the right will enable quick estimates.

You can easily make your own device for solving any such problem. Take the A or C scale of an ordinary slide rule and lay it end to end, say, nine times. Each time mark off the principal dividing lines. You will then have a chart like the one on the right except that yours will be much longer and, consequently, much more accurate.

The writer followed the above method and then reduced his chart to the much smaller size reproduced on the right. By the same method you can make a chart that will go into the billions, trillions or higher and down to a billionth, trillionth or lower. There is, in fact, no limit in either direction. To keep track of the places, you simply read the numbers as they stand on the chart. No "juggling of digits," as they say, is necessary. The writer does not know of any other method for estimating powers and roots that is as simple as this.

Let's illustrate the use of the chart with a simple problem:

What is the 5th root of 100,000? Measure the distance A from 1 to 100,000 as indicated on the chart. The distance B must then be exactly 1/5 of the distance A, and there is your answer; namely, 10. The principle, you will recognize, is to divide the distance from 1 to the specified number by the number representing the given root, in this case 5. The quotient shows you the distance to measure from 1 to find the answer. Point 1 is always your starting point; measure from it in either direction.

Most people usually find it harder to extract the square, cube or other root of a decimal fraction than of a whole number. With this chart, however, one is as easy as the other. For example, what is the cube root of 0.008? Measure the distance C from 0.008 to the starting point, 1, and divide it by 3. You get the distance D, which tells you the desired root is 0.2. Cube it and see.

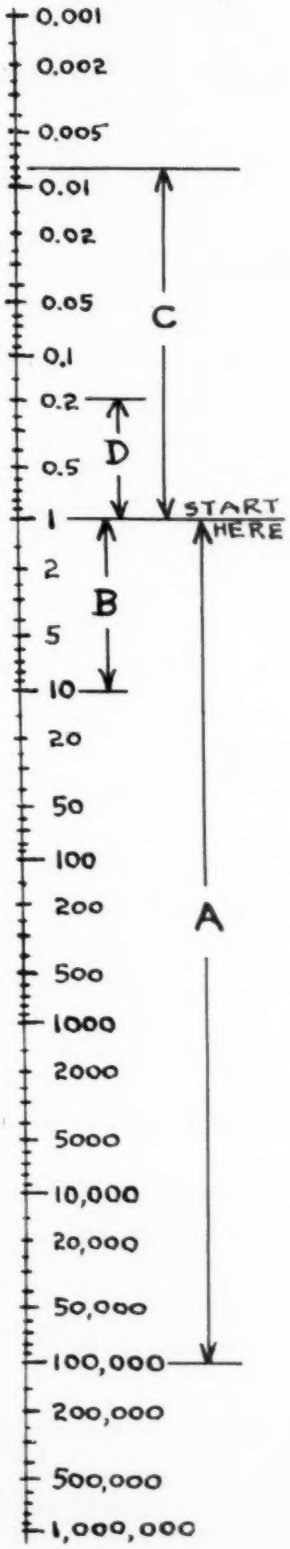
A way as easy as any to find a third, fourth, fifth, etc. of a given distance is to use a pair of dividers. Adjust the dividers until you get the distance D exactly 1/3 of the distance C. The chart will then give you the answer without any mathematical calculations.

With this chart you can determine the 3.21st power—or any other fractional power. You can also extract the 4.37th root or others like it. The numerical values of numbers raised to such exponents as 3.21 and 1/4.37 have hitherto been impossible to compute except by logarithms or with the aid of a log-log slide rule.

To solve such problems, it will be necessary to replace the dividers with an engineer's scale of inches divided into tenths. Let us suppose that our problem is to extract the 4.37th root of 100,000. The scale of tenths is set so that its 0 division is opposite the starting 1 of the chart. Measure the number of scale divisions between 1 and 100,000; there are 49. Divide 49 by 4.37. The quotient, to three places, is 1.12. Find 1.12 on the engineer's scale, estimating the final 2 between the even scale divisions. Opposite this scale point, the desired root will be found on the chart—about 14. A check with a four-place table of logarithms gives the answer as 13.94.

Oddly enough, roots are more accurately estimated than powers. This is because you multiply the error of estimation in obtaining a power but divide it when you are finding a root. Let us suppose that our problem is to raise 10 to the 3.21 power. The distance from 1 to 10 as measured on the engineer's scale seems to be almost exactly 10. Remembering, however, that there were 49 divisions between 1 and 100,000, a better value for the distance will be obtained by dividing 49 by 5; the quotient is 9.8. Multiply 9.8 by the exponent 3.21; the product is not quite 31.5. With the engineer's scale set as before to start at 1 on the chart, find the point 31.5. It falls somewhere between 1,600 and 1,700 on the chart. A check with a four-place table of logarithms gives the answer as 1,622.

There is no mathematical jugglery involved in the use of this chart; you have everything before your eyes in black and white.



Introducing

4 ENTIRELY NEW FLUXES

by VICTOR

Developed to Give You Cleaner, Stronger Welds at Lower Cost

These 4 new fluxes—One of the greatest developments in fluxes in 20 years—are the result of intensive engineering research based on Victor's 40 years of practical welding experience. Try them; see for yourself how to get *more brazing per pound* with these 4 new fluxes.

Victor's New Fluxes Fulfill All these Important Requirements

- Effectively clean parent and filler metal
- Cling to heated rod when dipped into flux
- Do not blow off rod
- Contain no useless ingredients
- Leave finished braze clean
- Contain no toxic ingredients
- "Tin" burned spots in cast iron brazing
- Do not encourage cooling of cast iron welds

Get your supply from your welding dealer **TODAY**

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Victor No. 3 Flux for brazing brass and bronze, steel, clean cast and malleable iron. Leaves clean, natural finish.
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Victor No. 5 Flux for moderate heat brazing of cast and malleable iron. Excellent for dirty castings.
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Victor No. 9 Flux for cast iron welding. Fast and effective. Will not cake when container is subjected to moderately high heat.

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"Give us the tools . . ."

What Are *YOUR* Chances If There Are No Profits?

Since the November 2 election there has been a dazzling variety of plans to have the government do more and more things and spend more and more money. But there is almost no variety in the plans which are suggested to raise the money.

"Pay for it by taxing profits," is the standard refrain. Slap on an "excess" profits tax. Boost the corporations' income tax rate.

Well – why not? Haven't the corporations been making so much money that a big chunk of it can be turned over to the government spenders without hurting anybody?

The answer is no!

How high profits should be can be debated endlessly. Some people claim that 1948 corporation profits, which will amount to about $20 billion, are too high. They emphasize the fact that profits are larger in relation to investment than they were a few years ago. Other people think profits are low. They stress the fact that profits are not much larger in relation to sales than they have been historically. Both sides agree that in some individual cases profits have been too high, as in others they have been too low or non-existent.

But if we cut the total volume of profits drastically, we shall do so at our national peril.

There is no room for debate about that. For we shall choke off the crucially important job of building new plants and equipment for our industries. Squeeze hard enough, and America will go the way of Britain – down the long and painful skids of industrial decline. Widespread unemployment, especially among our industrial workers who produce new plants and equipment, will mark the dreary way. Here is a fact which the President, the Congress, the C.I.O., and all of us have a real reason to remember:

Almost two-thirds of all profits today are going to rebuild and improve plants and equipment.

More than $13 billion of this year's profits are being plowed back. They are going – as a large proportion of profits have always gone – to buy for workers better tools to work with, better surroundings in which to work. They are making possible better products, and more of them, for all of us.

The figures below show how companies have put more and more profit-dollars and a larger share of their profits to work in the business:

YEAR	PROFITS REINVESTED	% OF TOTAL PROFITS
1929	$2.6 billion	31%
1939	1.2 "	24%
1943	5.9 "	57%
1944	5.2 "	53%
1945	4.2 "	47%
1946	6.9 "	55%
1947	11.2 "	62%
1948 est.	13.0 "	65%

continued on next page

The record shows that each of us is the real beneficiary of this plowing back of profits.

Every American has benefited from these profits. Each dollar that business has put into its plants and equipment in the last thirty years has increased our yearly production by 35 cents.

This re-investment of profits has helped make possible a 75% increase in living standards since 1919.

It has helped increase wages from an average 48 cents an hour in 1919 to $1.36 today. Allowing for higher prices, that increase means that an hour's work today will buy twice as much as it did thirty years ago.

Why must business retain these billions of profits to improve its plants and equipment? Why must it plow back more and more? *The reason is that business already is caught in a tax squeeze.*

Federal taxes alone take at least thirty-eight of each one hundred dollars a company earns. Then, if the company pays out to its stockholders any part of what is left as dividends, the federal personal income taxes of the stockholders may take up to 77% of those dividends. Under these conditions, so few people are willing to invest in industry that the stock market is stagnant. Companies can not raise in that market the money they need for improvements.

The result: business must rely more and more on plowed-back profits to pay for new plants and equipment.

We know that everywhere in industry new and better ways of producing goods are standing ready for use. The previous editorial in this series mentioned some of them. We know, too, that depression and war put our industries far behind schedule – as much as $100 billion behind – in getting the new tools they should have had to keep themselves in first-class shape. McGraw-Hill is now completing a survey of industry that will measure these needs. The results will be published in this editorial series. We know already that in 1949 alone industry will need $18 billion or more for this purpose.

And all but a small fraction of that sum must come from profits.

Our prosperity, our strength as a nation, our hopes for better living depend on our continuing to generate and to plow back a large volume of profits.

For that reason we should not thoughtlessly follow these people who propose to pay for any and all new government activities by saying simply, "Soak the corporations." There is no need to follow them. There are other ways of obtaining necessary funds.

First and foremost should be economy within the government itself. If its citizens must pay still higher taxes, then surely government should exercise rigid self-restraint, cutting out all but the most essential activities and expenses.

After economy should come consideration of a broader federal tax base.

If these and other methods of raising money are inadequate and if taxes must take a bigger bite from business profits, two facts are clear. We should not adopt an "excess" profits tax with all of its complications and all of its corrupting effect on business. A moderate increase in the regular income tax on corporations is much less dangerous. *But even such an increase, if necessary, should be accompanied by special allowances for expansion and depreciation that will encourage companies to continue spending their earnings for new plant and equipment.* We all have a stake in that.

At this critical juncture in our history profits have a new and vastly more important role than they have ever had. In unprecedented degree they are the drive behind our present prosperity and the key to a better, stronger future.

Give profits the axe and the blow does not stop there.

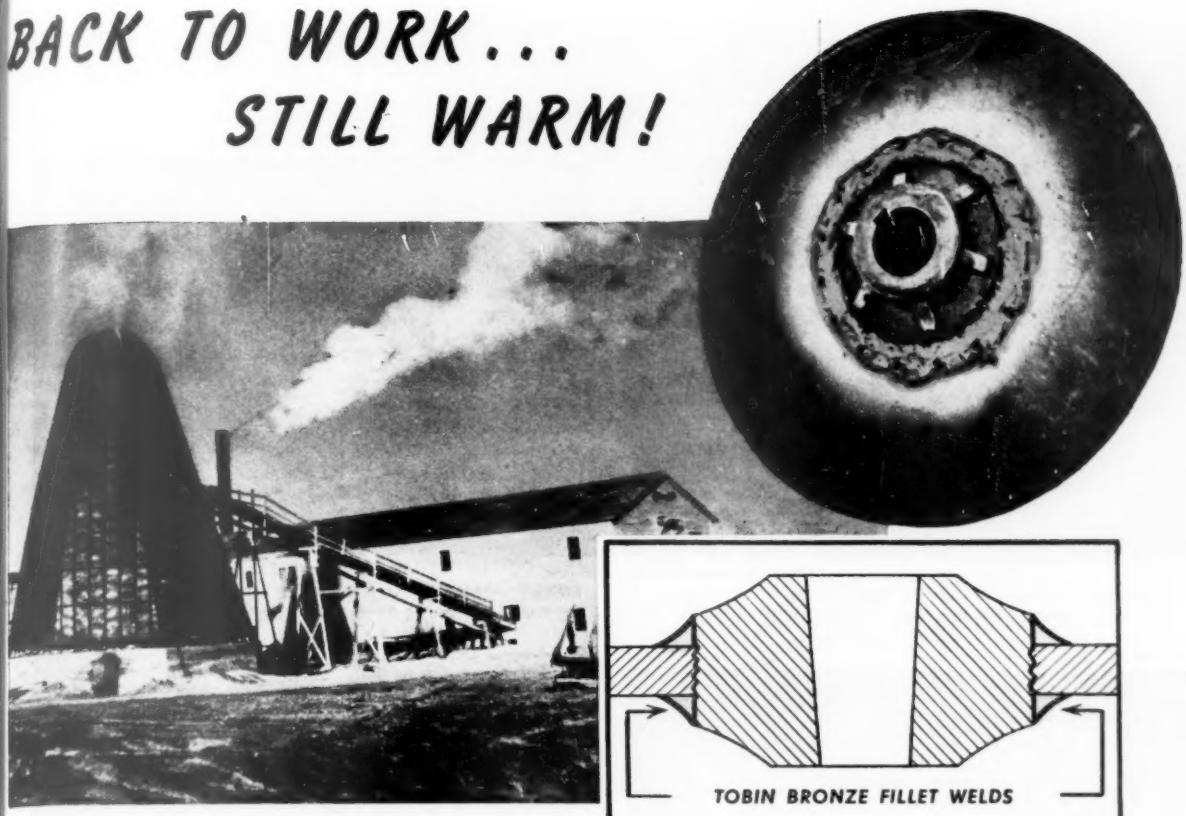
It cuts into the employment, the prosperity and the strength of our nation.

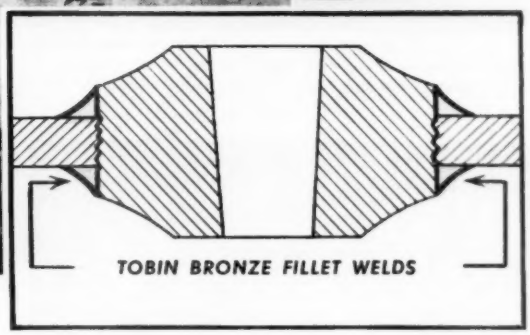
Everyone of us has a stake in how the President and Congress handle taxes on profits – and now is the time to remind them of that stake.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

BACK TO WORK... STILL WARM!





Ingenious Tobin Bronze Repair Weld cuts 10 day layoff to 7 hours downtime in Saskatchewan sawmill

FRACTURE of a vital part in the Reserve, Saskatchewan, mill of the Pas Lumber Company threatened a ten day shut-down in the height of last winter's logging season.

The 30″ cast iron friction disc of the mechanism controlling the travel of the log carriage, cracked completely around its hub. The nearest spare disc was in Quebec, half a continent away.

Ernest J. Morris, welding and diesel engineer for the company, and a veteran of many crises in the wilderness, fitted the disc back on the hub, using the jagged edges of the break to locate the disc and give it accurate alignment. Since it must run true within a few thousandths of an inch and there was no lathe at hand large enough to reface the disc, the break was left untouched without veeing and the repair made with fillet welds of Tobin* Bronze and a controlled welding technique.

Seven hours after the break, the mill was operating again and 60 men saved from a layoff. Today, nearly a year later, Mr. Morris reports the unit has operated perfectly and at twice the former hours of service.

Through such emergencies as this, operators of every type of machinery are learning that "Don't scrap it, *weld* it" is good advice. For complete information on bronze welding and the fourteen different Anaconda Welding Rods now available, write for Publication B-13.

*Reg. U. S. Pat. Off.

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THE AMERICAN BRASS COMPANY

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Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
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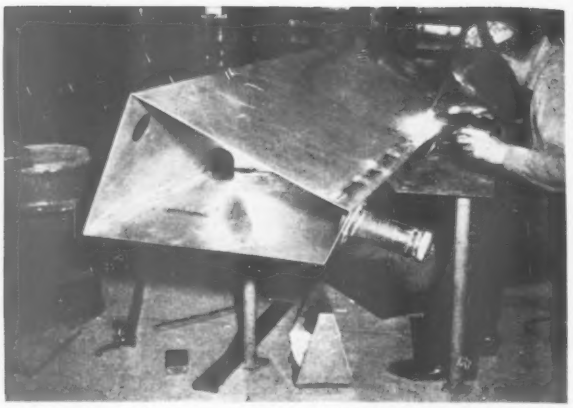
on the job

Courtesy Dravo Corp.

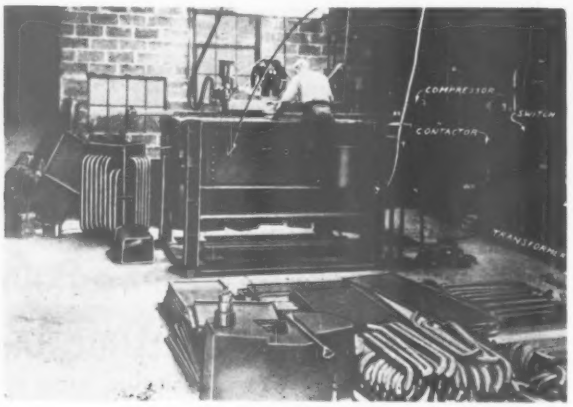
OIL-FIRED HEATERS at Dreis and Krump, Chicago, help exhaust welding fumes. Welding area is kept under air pressure to force out fumes



Courtesy The Linde Air Products Co.

INERT-GAS-SHIELDED arc welding on aluminum fuel tanks. Here the operator is making the finish weld on one of the longitudinal seams

STAINLESS-STEEL strips are welded to big drums of the same material by a semi-automatic welding head mounted on a traveling carriage



AUTOMATIC WELDING machine for transformer cases. The cantilever beam carries a copper back-up bar, against which work is air clamped

Drums for Vacuum Filters

THE semiautomatic "hidden-arc" welding process has been adapted by Hudson Francom, shop foreman, filtration division of the Eimco Corp., Salt Lake City, for production of vacuum filters.

According to Francom, the process permits continuous welding of such materials as stainless steels, duriron, silicon bronze, etc. Differing gauges of materials and different rods are readily welded. In the picture above (left, bottom) the semiautomatic head is mounted on the carriage of a straight-line cutting machine to weld stainless-steel strips to stainless-steel drums.

* * *

Heaters Remove Fumes

WELDING fumes are being effectively removed from a block-long Chicago factory building without the use of exhaust fans or an elaborate air conditioning system. The building is the Chicago plant of Dreis and Krump Manufacturing Co., one of the nation's largest makers of forming dies and steel press brakes.

During the summer months, natural draft from open windows and doors carried away most of the welding fumes through high (39 ft) bay windows. In winter, however, the factory frequently became so foggy that visibility was impaired. The new method of ventilating makes use of four high-velocity, direct-fired heating units and is effective in both summer and winter.

In the winter, the cold air is warmed by the four oil-fired heaters, each of which has a capacity of 2,000,000 Btu per hour and is capable of handling about 22,000 cfm of air.

Air is drawn into the heaters through louvered openings in their bases and is first passed over two staggered banks of economizer tubes leading from the combustion chamber to the vent stack. The preheated air then sweeps the stainless-steel combustion chamber and is discharged into the working area at a velocity of approximately 2,000 cfm and a temperature of approximately 80 F. The four discharge nozzles on the heaters are located 12 ft above the floor.

The objective is to bring sufficient quantities of fresh air into the building to keep the working area under pressure. As the warmed air is blown into the working zone of the factory, welding fumes are forced up to the roof windows. In the summer, only the fans in the heaters need to be operated.

* * *

Argon-Welded Aluminum Tanks

CLEAN, corrosion-free welds were demanded in fuel tanks to be fabricated from 10-gauge 3S-½H aluminum. Each tank required approximately 40 ft. of welding. Specifications provided that all inside surfaces affected by welding be cleaned of scale, weld spatter, foreign matter and also treated for corrosion. The fabricator eliminated all of these operations by using the inert-gas-shielded

ocess with argon to make the tanks. Top and front side of each tank were formed from one sheet of aluminum; bottom and back side from a second sheet. After two baffle plates were tack welded to the bottom section, the top section was set in place and tacked down along the two longitudinal seams. Tack welds 3 in. long were made in the center and on each end of the 87-in. longitudinal seams. Between these welds, 1-in. tacks were made every 6 in. The welding operator then finished tacking the baffle plates on the inside.

End plates were fitted on and tack welded every 6 in. Wear plates ¼ in. thick, 8 in. wide and 50-in. long were welded to the bottom of the tank. Before all the seams were completed, the pump was tacked to the tank. The two steel inlet pipes were then rubber flanged and riveted to the top section.

Total welding time, including tack welds, was approximately 1¾ hr per tank. Because of the small heat spread and minimum warpage, it was possible to do all assembling without the aid of any jigging. Current was high-frequency-stabilized a-c—100 amp for tacking, 130 amp for baffle plates, 150 amp for wear plates and 80 amp for side seams and corner welds. An aluminum filler rod (5% silicon) was used on all welds.

* * *

Set-up for Transformer Cases

EISLER Engineering Co., Inc., Newark, N. J., adopted the submerged-melt automatic welding process for the manufacture of transformer tanks. The welding machine shown in the right bottom picture (page 70) consists fundamentally of a welding head mounted on a self-propelled travelling carriage with stepless speed control of from 7 to 210 ipm. The carriage is movable on a track bolted to the jig.

Important parts of the jig structure are: a cantilever beam turning around a fulcrum on its outer end and numerous movable fingers built into both sides of the jig. Each finger is hinged on its outside and provided with a return spring. These fingers are controlled by compressed air through a self-aligning pressure device (fire hose).

To start the welding operation, the work is slipped over the lowered cantilever beam. The beam is raised by air pressure and held in a horizontal position. Immediately thereafter the interposed fire hose is inflated by compressed air, and all fingers are simultaneously moved downward, aligning the edges and clamping firmly the longitudinal section of the tank. The welding head travels the length of the piece to make the weld in a single pass.

The transformer needed for this automatic welding installation was also designed and built by Eisler. It is composed of four 250-amp transformer units of the same voltage characteristics, which can be temporarily or permanently paralleled for current adjustment. One of these transformer units is motor-operated to make the fine adjustment; the three others are hand-cranked.

4 reasons why TITAN Bronze Welding Rods are First choice

1 Careful alloying, plus thorough deoxidation, results in strong, ductile welds.

2 Close metallurgical control assures constant uniformity of product.

3 Seven types of rods provide for all applications. You can choose the rod exactly suited to your needs.

4 Large warehouse stocks permit us to fill your order promptly. TITAN Bronze Welding Rods are available in the quantities you need *when* you need them.

TITAN Bronze Welding Rods are concisely described in our 6-page folder. Useful suggestions for making better welds have also been included. Write for your free copy today.

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GENERAL OFFICES AND PLANTS
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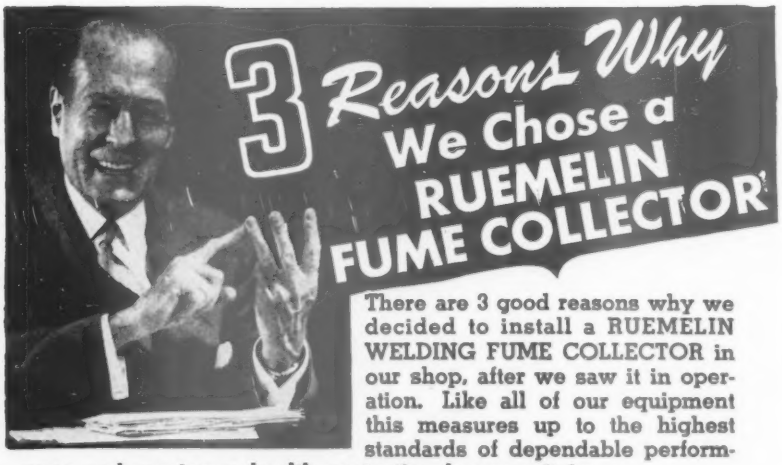
Quality Alloys by Brass Specialists
Brass and Bronze Rod · Forgings · Die Castings · Welding Rods

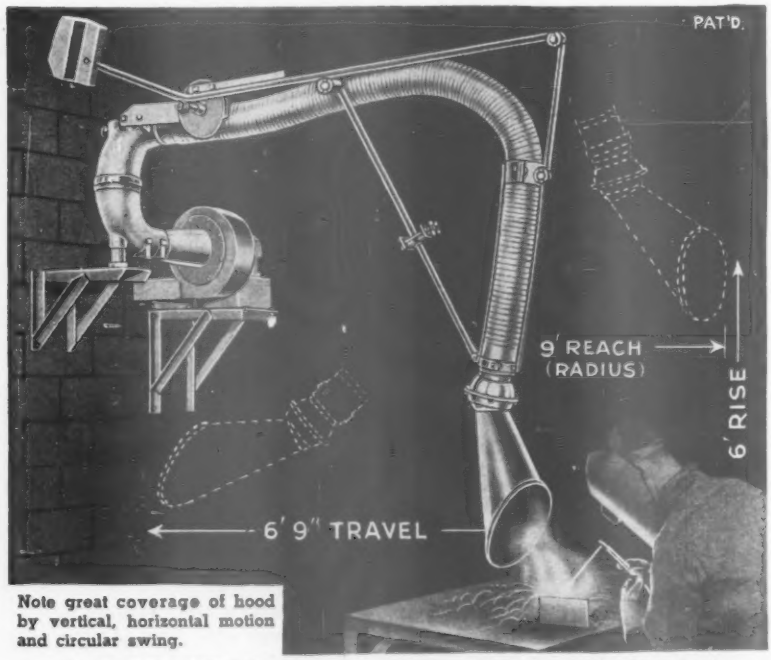


There are 3 good reasons why we decided to install a RUEMELIN WELDING FUME COLLECTOR in our shop, after we saw it in operation. Like all of our equipment this measures up to the highest standards of dependable performance and maximum health protection because it is:

1. MORE EFFECTIVE — The powerful suction of the RUEMELIN FUME COLLECTOR efficiently draws out noxious gas, smoke and heat at the source. It provides great coverage, minimizes building heat loss, reduces welder's fatigue and guards employee's health — all to increase shop efficiency and output.

2. COMPLETELY FLEXIBLE — It is easily installed with least expense. When in operation, its hood instantly and conveniently adjusts for greater proximity to welding area without tedious adjusting devices.

3. UNIVERSALLY APPROVED — The RUEMELIN FUME COLLECTOR has the approval of state industrial commissions and compensation insurance companies. In addition it has the support of the thousands of users who have found their Ruemelin installations so satisfactory on the job.



Note great coverage of hood by vertical, horizontal motion and circular swing.

Standard Model D-5310 with hood reaching out 9 feet from wall. Also available in Long Reach Model D-5342 with hood reaching out 15 feet from wall.

For complete details write for Bulletin 37-C

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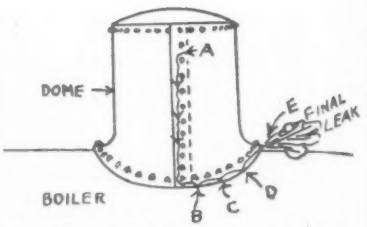


RIVETED SEAM allowed a steam boiler to leak successively at B, C, D and E. Other end of leak was at A near top of the dome

Queer Leaks in Boiler

By W. F. Schaphorst, M.E.

HERE's what can happen to riveted steam boilers! The first leak showed up around the saddle of the boiler dome at the point marked B in the sketch. It was calked and stopped. Shortly afterwards the steam came out at C, and the calking operation had to be done again. Then at D, and finally at E, the story was repeated.

By this time the boiler operator was aroused and determined to do something about it. He emptied the boiler and, by means of an ingenious gasketing and holding device, reversed the flow of steam, forcing steam into the leak at E. Imagine his surprise when he found that the other end of the leak was at A near the top.

The seam at A inside of the dome was then calked and that ended the trouble. None of these leaks would have occurred if the seams had been welded.

* * *

Welder Capacity Doubled

FLINT Tool & Manufacturing Co., of Holly, Mich., was using a projection welder to join a tapped plate inside of an oil pan to hold the drain plug. Production schedules made it necessary to double the output per shift. As far as the welding operation was concerned, this was achieved very simply by adding a second operator to handle materials in and out of the machine and changing the method of transporting parts.

Under the new set-up, the same welder produces some 700 assembled pans per hour, a total of 5,600 assemblies in every eight hours as compared to the previous 3,000.

Courtesy Progressive Welder Co.

PROJECTION WELDING tapped plate inside oil pan on 75-kva welder at Flint Tool Co.

New Products to Use

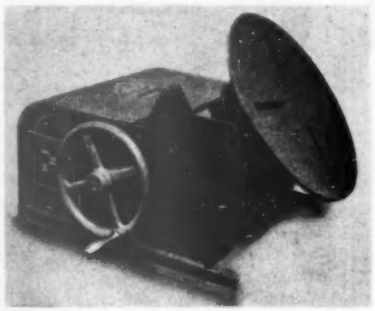
UTILITY model a-c welders rated up to 200 amp; industrial models up to 2,000 amp

A-C Welder

NEW line of a-c welders with ratings of from 100 to 2,000 amp is in production by GLENN-ROBERTS CO., 2107 Adams St., Indianapolis 18. Utility models are rated up to 200 amp at 30 volts, 50% duty cycle. Model 180, of limited-input type, has 180-amp rating, 25 volts, 20% duty cycle. Industrial units start at 200 amp and go to 500 amp for manual welding; automatic welders have 750 and 1,000 amp ratings with single transformers and 1,000, 1,500 and 2,000 amp ratings in multiple-transformer models.

Power-factor correction is standard on all industrial models and optional on utility models. All models are equipped for dual-range output.

* * *



100-LB CAPACITY Ransome positioner has a motor-operated rotatable table top

Work Positioner

NEW motor-operated work positioner, Model 1-P, is driven by a hydraulic variable-speed transmission and a ½-hp single-phase a-c motor. It has a load capacity of 100 lb. Table top rotates 360 deg in either direction at speeds adjustable from 0-5 rpm. It is manually tilted through 135 deg and locks at any angle. RANSOME MACHINERY CO., Dunellen, N. J.

* * *

GASOLINE and electrical fires may be stopped with small dry-chemical extinguisher.

Fire Extinguisher

DRY chemical fire extinguisher has been designed for effective use by inexperienced operators on gasoline and electrical fires. It contains 2 lb of dry chemical said to be non-toxic, non-conductive, non-corrosive and non-abrasive. Fill cap is built into the mounting bracket which makes it ready for use as soon at it is removed. ANSUL CHEMICAL CO., Fire Extinguisher Division, Marinette, Wis.

* * *

Composite Weld Stud

NEW type of composite aluminum and mild steel "Rivweld" rivet stud is said to overcome the corrosion problems met when aluminum roofing is secured by steel fastenings.

It consists of a mild-steel female stud into which has been fitted a cross-shaped insert of aluminum. Mild steel in the flux-filled end of the stud, secured to steel purlins, struts or gerts, and aluminum in the upper portions which come in contact with aluminum sheet is said to leave little or no opportunity for electrolytic action. An aluminum-surfaced neoprene washer for use with the composite stud is also available. NELSON STUD WELDING DIVISION, MORTON-GREGORY CORP., Lorain, O.

* * *

Bronze Electrode

NEW phosphor-bronze electrode for arc welding of copper, bronze, brass, malleable iron, etc., is produced by ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y. It is recommended for bearing and corrosion-resistant applications. Welds are said to have a tensile strength of 40,000 psi and a Brinell hardness of 70-80. Known as All-State No. 22 Phosphor Bronze "A", this electrode is available in 3/32 to 3/16 in. diameters.

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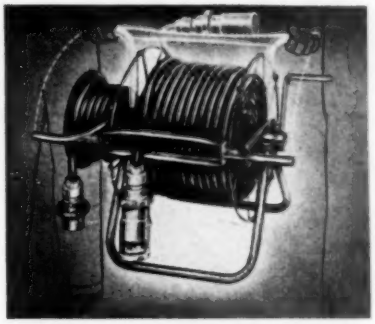

HEAVY CABLES are carried by "Powereel"

Cable Reel

NEW portable "Powereel" is designed to house up to 300 ft of ¾ in. No. 12 four-conductor cable. Twin handles are provided for carrying. Tubular steel supports can be used as sled runners to help pass the reel in and out of trucks, etc. Standard equipment includes three or four beryllium-copper collector rings with double copper contact brushes, seated in a phenolic casting. Without cable and plugs, the reel weighs 21 lb. INDUSTRIAL ELECTRICAL WORKS, Dept. 64, 1509 Chicago St., Omaha 2, Nebr.

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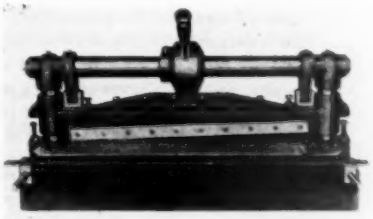


Metal Shear

CUTTING range of the new "Di-Acro" shear No. 4 extends from light plastics, fiber and rubber to aluminum, chromemoly steel and stainless. Maximum shearing width is 24-in. with maximum material capacity of 0.062 in. sheet steel. A protracting gauge for squaring and mitering and a material gauge are provided. O'NEIL-IRWIN MFG. CO., 385 Eighth Ave., Lake City, Minn.

* * *

Solder Dispenser

NEW pocket container for a coil of silver alloy is being marketed by EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York 13. Called "Eutec-Silver-Weld Pocket Economizer," it dispenses the alloy through a hole in the top. A compartment in the bottom contains flux. The dispenser is expected to be used in shops repairing utensils, electrical connections, pipe and tube fittings, etc.

Multi-Pic

—THE FIRST REAL IMPROVEMENT IN WELD HAMMERS

NOW EQUIPPED WITH

Repeater Brush

THAT WEARS AND WEARS AND WEARS

Multi-Pic is the improved weld hammer with 5 separate pic-pointed tool steel heads locked between free floating guide plates. Each single stroke of **Multi-Pic** gives five surface cleaning blows. The five picks adjust themselves automatically to the varied surface of any concave, convex or irregular shaped weld and clean quickly, easily, with fewer blows. Pic points are hardened, tempered tool steel which lasts indefinitely and can be resharpened.

Repeater Brush whisks away loosened slag, oxides and rust in a jiffy. The unique design makes it easy to reach into the deepest corners and crevices. The crimped oil hardened wire brush is provided with five quick and simple adjustments to compensate for wear and lasts five times as long as an ordinary brush.

Multi-Pic is supplied with double 5-pic pointed ends or with dual 5-pic and 25-pic pointed ends as illustated with or without the Repeater Brush. Extra Brushes—three in a carton.

ORDER FROM YOUR DEALER TODAY!

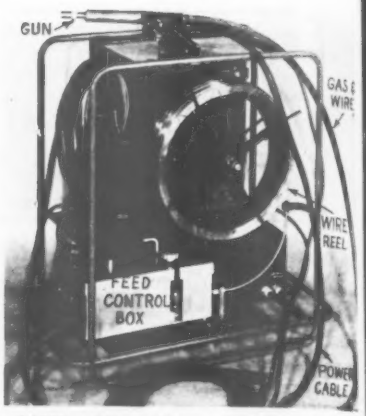
Try **Multi-Pic** in your own shop—on your own work. You'll welcome the quick, cleaner work of this new weld hammer which follows the contour.
If your dealer cannot supply you, write us for descriptive folder and name of nearest supply house.

Patents Pending.

BERNARD

WELDING EQUIPMENT CO.

741-743 East 71st Street • Chicago 19, Illinois



RAPID welding of heavy aluminum sections is possible with new "Aircomatic" process

Inert-Arc Welding Gun

NEW "Aircomatic" process has been announced by Air Reduction (See THE WELDING ENGINEER, December, 1948, for details). An inert-gas-shielded metal-arc process, it consists of feeding a consumable wire through a hand-operated welding gun. For the welding of aluminum only three sizes of filler wire are needed: 3/64, 1/16 and 3/32-in.

Component parts of the "Aircomatic" unit are the gun, gas hose (concentric with which is the metallic tube for conveying the welding wire), three-conductor control cable, feed motor box, control box and wire reel. Welding gun is equipped with a trigger which readies the unit for welding and a "job button" for feeding wire when not welding. To start welding, the trigger is depressed, which starts the flow of shielding gas. When electrode is scratched on the work, arc voltage is established, and controls operate to energize the feed motor and deliver filler metal. AIR REDUCTION SALES CO., 60 East 42nd St., New York City 17.

* * *

360-CYCLE GRINDER has motor spindle speed of 21,600 rpm, geared down for 6-in. wheel grinding, buffing and polishing

Portable Grinders

ROTOR TOOL CO., 17325 Euclid Ave., Cleveland 12, announces a new line of 360-cycle portable abrasive tools including wheel grinders, cone sanders, straight grinders and cup grinders.

Motor in these 360-cycle tools is a squirrel-cage induction type. Speed is governed by the frequency of the power supply from an induction frequency converter or motor generator. Spindle speed of 21,600 rpm, is used direct for small wheel work, mounted points or rotary files. For heavier work such as wheel grinding, sanding, buffing or polishing, the motor is geared down.

Cost of operating these 360-cycle tools is claimed to be one third that of similarly rated air tools.

MULTI-PURPOSE electric tool cuts metal with silicon-carbine disc, also drills metal

Power Tool

MULTIPURPOSE power tool, the D-6, will drill, grind, polish or cut by simple change of attachments. It is said to drill holes up to ¼ in. in metal and up to ½ in. in wood. Drill chuck can be used for numerous attachments such as hole saws, wire brushes, cup grinders and abrasive points.

Stiff 7-in. disc infused with silicon-carbide grit is used edgewise to cut through metal. A guide grip can be attached to either side of the tool. Speed is 3,000-rpm at no load and 2,000-rpm at normal load. Net weight of tool is 5 lb 13 oz. PORTER CABLE MACHINE CO., 1714 N. Salina St., Syracuse 8.

* * *

DOUBLE-LAYER insulation is provided for primary and secondary coils of a-c welder

Industrial Welder

HEAVY duty a-c welder with a normal rating of 275 amps at 40 volts, 50% duty cycle, is being manufactured by WILL-WELD MFG. CO., 1533 Marcy, Omaha, Nebr. Smooth, stable arc characteristics are claimed. All connections are silver-brazed. Multistrand coils, in which each strand is covered with two layers of fiberglass, are said to eliminate hot spots in the machine. Dimensions are approximately 17 by 19 by 46 in.

* * *

Fire Extinguisher

AMERICAN-LAFRANCE-FOAMITE CORP., of Elmira, N. Y., announces a new line of 2½-gal welded silicon-bronze fire extinguishers. Soda-acid, foam, plain water and anti-freeze water types are included. Each is 4½ lb lighter in weight than previous models and is fitted with a transparent plastic nozzle, claimed to offer more resistance to accidental blows than the old lead nozzle.

STEAM HAMMER REPAIRED IN ONLY A FEW HOURS WITH BRIDGEPORT No. 192 LOW FUMING BRONZE

It took only a few hours to repair the frame and bed of this Chambersburg Steam Hammer with a hundred pounds of Bridgeport's No. 192 Low-Fuming Bronze Rod. Not only were weeks saved, but the excessive cost of replacement was avoided.

But most important, braze-welding is strong and can stand the severe day-after-day pounding of steam hammer operation! Repaired four years ago, it has not been favored and is performing as well as ever.

For strong, sound, tough repairs . . . often stronger than the original equipment . . . use economical braze-welding. Save preheating time and avoid warping. Send for Bridgeport's twenty-four page booklet "Bronze Welding Alloys", which should be in every maintenance department.

"Bridgeport" BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • Established 1865
Mills at Bridgeport, Conn., and Indianapolis, Ind.
In Canada: Noranda Copper and Brass Limited, Montreal

WELDING ALLOYS AVAILABLE

BRIDGEPORT No. 192 BRONZE—LOW FUMING
General purpose alloy. Ideal for repairing heavy-duty equipment as well as small parts—building up wearing surfaces—joining parts in industrial and construction work.

NAVAL BRASS
Fuses readily at 1625° F. Recommended for uniting cast iron and steel parts—building up wearing surfaces—joining parts in industrial and construction work.

BRAZING ROD
Satisfactory for conditions that are not subject to great wear or heavy shock loads.

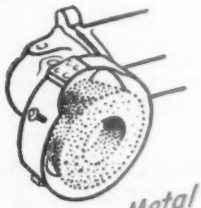
BRIDGEPORT MANGANESE BRONZE (NAVY)
Recommended for strength and toughness in repairing cast iron and steel castings—building up worn surfaces—joining parts in industrial and construction work.

BRIDGEPORT No. 632 and No. 609 SILICON BRONZES
Both are used for oxyacetylene, carbon arc, or metallic arc welding methods for making silicon bronze storage tanks, automatic heaters, corrosion-resisting ducts, structural sections, vats, etc. No. 632 contains more silicon, is slightly stronger and has a little lower melting point than No. 609.

Bronze Welding Rod A PRODUCT OF
BRIDGEPORT BRASS

Power to Save Time and Muscle Before and After Welding

Sands any Surface



Grinds any Metal

Speeds Wire Brushing

Van Dorn Portable Electric Sanders are packed with power to speed up a variety of welding jobs. You can quickly prepare the surface to be welded by using Van Dorn Sanders with abrasive discs and "Whirlwind"* Wire Cup Brushes to remove rust, scale, oxidation and old paint. With saucer grinding wheels, they do a fast job of "V-ing out" the joint to be welded. After the weld has been made, use Van Dorn Sanders with saucer grinding wheels for swift removal of excess metal—and with abrasive discs for a satin-smooth finish.

Ask your nearby Van Dorn Distributor for complete information on these versatile tools and for help on any tooling problem. For your free copy of our complete catalog, write to: The Van Dorn Electric Tool Co., 734 Joppa Road, Towson 4, Maryland.

*Trade Mark Reg. U. S. Pat. Off.

FOR POWER SPECIFY

"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

PORTABLE ELECTRIC TOOLS

MAGNETIZED faces on magnetic ground hold it to round or flat surfaces of work piece

Magnetic Ground

NEW magnetic ground called "Magnetrode" is claimed to improve the quality of arc welding because of magnetic action. Other advantages claimed are reduced time and labor, less magnetic blow and less resistance and spatter. Model 700 is an all-purpose a-c/d-c ground with four permanently magnetized faces for use on either round or flat surfaces. Capacity is 500 amps on cables up to 4/0. VANOL CORP., 4170 Hartford St., St. Louis 16.

* * *

STABILIZATION of ±1% on 115 volts is claimed for new Raytheon stabilizer

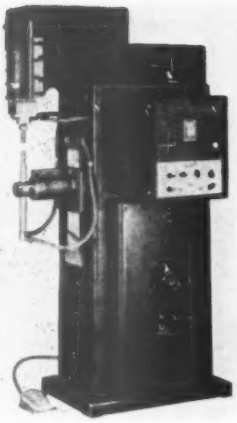
Voltage Stabilizer

RAYTHEON MFG. CO., Waltham 54, Mass., has added a new model to its VR-6000 voltage stabilizer line. This is a hermetically sealed, oil-filled, frequency-compensating model of 15 watts rating. Input frequency range is 57 to 63 cycles, input voltage 95 to 125 volts, and output 115 volts stabilized to ± 1% for both line and frequency regulation.

* * *

Flow Meter

NEW "Metco Type GF" gas flow meter unit is now available for metallizing guns. Advantages claimed for its use are: adjustable gas balance suited to each metal, immediate indication of any restriction in gas flow or pressure change, more uniform sprayed metal coatings. METALLIZING ENGINEERING CO., INC., 38-14 30th St., Long Island City 1, N. Y.

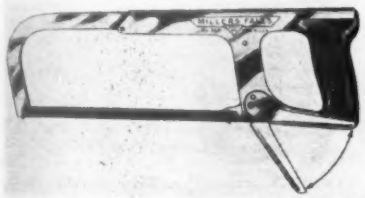


DURABLE transformer construction is featured on new projection welders

Projection Welder

HEAVY-DUTY, air-operated press-type projection and spot welders are being produced in 50 to 200 kva capacities by UNIVERSAL WELDER CORP., 760 Carnegie Ave., Cleveland 15. Transformer construction utilizes asbestos insulation and a new impregnating varnish of the modified silicone type capable of withstanding 400 F temperatures. Press head has cylinder built as an integral part of and moving with the sliding head, while the piston remains fixed.

* * *



LEVER ACTION facilitates blade changing and maintains constant tension on blade

Lever-Action Saw Frame

NEW hacksaw frame features a lever action that is said to apply greater and more uniform tension on the blade and to allow faster blade changes. When lever, which normally hugs bottom of frame handle, is pulled down, a cam mechanism releases tension. Blade may be inserted facing in any of four directions. Correct tension is automatically applied. Either 10 or 12 in. blades may be used. MILLERS FALLS CO., Greenfield, Mass.

* * *

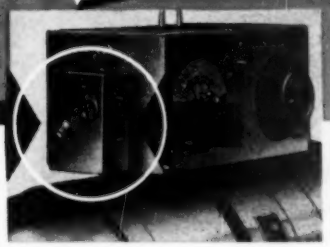
Silver Alloy

"EUTECROD 1700" is a thin-flowing high silver alloy said to give a good color match to stainless steel. It can be used on all types of joints and for sealing and filling small cracks and defects. Another use is the joining of tungsten-carbide tips to steel shanks.

The rod bonds at 1,020-1,250 F and has a tensile strength of 64,000 psi. It is available in 1/64 to 3/32 in. diameters. EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York 13.

INCREASE SHOP EFFICIENCY WITH DV

START-STOP CONTROLS FOR ELECTRIC DRIVEN DC-WELDERS



DV *automatically* . . .
STARTS the welding machine when arc is struck.
STOPS the machine when not required.

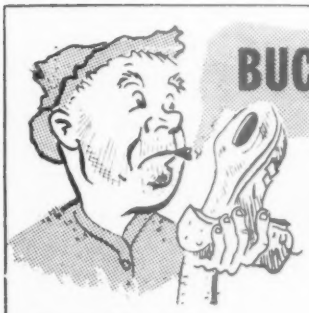
DV controls give you these important advantages . . .

- **Greater convenience** because the operator does not have to leave his work to start or stop the machine.
- **Reduced power consumption** because welders are automatically shut off two minutes after welding stops.
- **Less maintenance** because bearings, brushes and commutators have a longer operating life with DV controls.

These exceptionally dependable controls are easy to install and maintain. Sturdy construction and a minimum of working parts assure long, trouble-free operation. Write for new bulletin containing complete information on DV controls.

DV WELDING CONTROLS
OAKLAND 11, CALIFORNIA

Have you read this advertisement?



BUCKETS WEARING THIN?

REPLACE LOST METAL with

MANGANAL

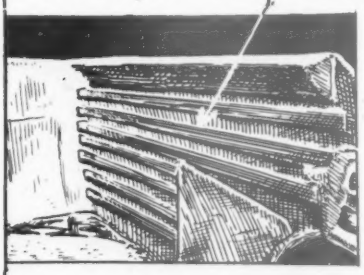
(Trade Mark Reg. U. S. Pat. Off.)

11-13½% MANGANESE-NICKEL STEEL

HOT ROLLED

FLAT APPLICATOR BARS

Interior of 9 yd. Stripping Dragline Bucket Relined With MANGANAL 4" x 1" FLAT APPLICATOR BARS



1. Tensile strength up to 150,000 p.s.i.—lighter sections can be used, increasing bucket pay loads.
2. Becomes harder (up to 550 Brinell) as going gets tougher—will far outlast other steels.
3. Easily fabricated—not harmed by heat of welding or flame-cutting.
4. Strongest welds to Manganese or Carbon Steels easily made with MANGANAL SPECIAL TITE-KOTE or BARE electrodes.
5. Fast, economical—more pounds of metal replaced per man hour. Available in 20 sizes.

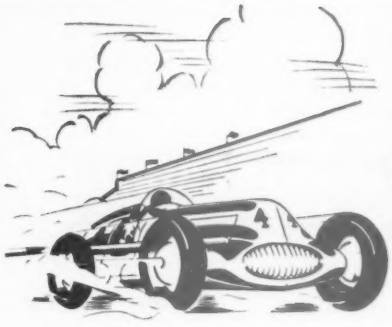
FREE: The "MANGANAL MARKETER" offers Helpful Hints on welding 11 to 14% Manganese-Nickel Steel. Write for your copy today!

NAME OF NEAREST DISTRIBUTOR ON REQUEST

STULZ-SICKLES CO.

SOLE PRODUCERS

91 N. J. Railroad Ave. Newark 5, N. J.



Speed and the ability to take it! are built into the

AUTOBODY

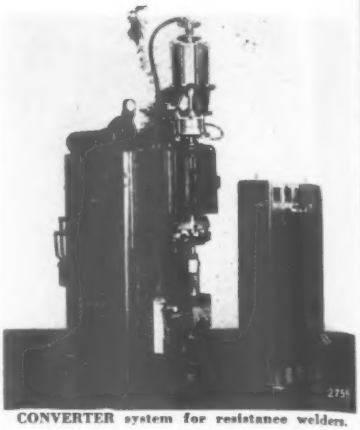
The Meco AUTOBODY is especially built for high speed mass production in the automotive and allied fields. Special features enable it to withstand the hard usage common to these industries. The welding head is machined of rugged rod stock and the sturdy tips are interchangeable. It embodies the famous Meco "On-Off" action, tested over 200,000 times without appreciable sign of wear. Other members of the AUTOMAT family are the MIDGE-O-MAT with light weight tip and needle flame for production work on all types of small articles, and the STANDARD for medium to heavy work.

Meco

Send for New MECO Catalog No. 130 today!

Modern Engineering CO., Inc.

3411 WEST PINE BLVD. **ST. LOUIS 3, MO.**

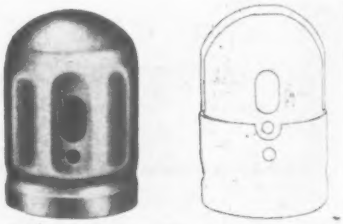


CONVERTER system for resistance welders. Auxiliary equipment is at right

3-Phase Converter

FOR spot, projection, seam and flash welders, the Thomson "Balanced Load" three-phase converter system is said to supply low-frequency single-phase current while placing an evenly balanced demand on a standard three-phase power source. Except for a special transformer, Thomson resistance welders using the new system are conventional in design. Thomson Electric Welder Co., 163 Pleasant St., Lynn, Mass.

* * *



LIGHTER octagonal cylinder cap has 50% extra thickness at the dome. Cap is 6 in. high

Cylinder Cap

OCTAGONAL cold-drawn steel cylinder cap is said to be lighter and provide larger holes for shipping tags than caps now used. Dome is 50% thicker than side walls to protect valves. Standard cap is 6 in. high and 3½ in. in diameter, threaded 11 threads to the inch. COMPRESSED GAS CYLINDERS, INC., P. O. Box 222, Vernon, Calif.

* * *

Polisher

VAN DORN ELECTRIC TOOL CO., has brought out new standard and automatic models of portable electric polishers. Gearing has been changed to a single-reduction spiral bevel gear; this change is said to have increased motor power 30% and raised speed to 1,500 rpm.

"Power Glaze," a cleaning liquid, can be fed directly from a built-in reservoir at the handle end of the automatic polisher by means of a tube through the hollow spindle. Polisher comes equipped with a 7-in. moulded rubber pad, sponge-rubber cushion pad, buffing pad and reversible side handle. VAN DORN ELECTRIC TOOL CO., Towson 4, Md.

INDUCTION preheating can be accurately controlled with new portable pyrometer

Portable Pyrometer

PORTABLE electric pyrometer recorder and/or controller can be arranged to handle as many as six different temperatures up to 2,200 F. This controller can be used with induction heaters and resistance heaters for preheating and stress relieving in welding operations. Dimensions are 30 by 24 by 22 in. deep. Weight is 100 lb. ELECTRIC ARC, INC., 152-162 Jelliff Ave., Newark, N. J.

* * *

MACHINABLE WELD made in cast iron. Cutting, drilling and tapping operations shown

Electrode for Cast Iron

FOR welding cast iron, LINCOLN ELECTRIC Co., Cleveland 1, recommends "Softweld," a new non-ferrous electrode specially developed to repair gray-iron castings. Electrodes previously manufactured under the name of "Softweld" have been discontinued. Weld deposits may be drilled, machined, sawed or tapped, it is claimed. Available in 14 in. lengths, 1/8 and 5/32 in. sizes.

* * *

Hard-Facing Electrodes

TWO iron-base hard-facing alloys, Haynes 90 and 92 are now available in rod and coated electrode form. Haynes 90 is recommended for hard-facing shredding machine parts, clam shell buckets, lifting hooks, chain links, etc. It is claimed to have excellent oxidation resistance up to 1,000 F. Deposit hardness is 56-58 Rockwell C.

Haynes 92 rod has a moderately low melting point and is suitable for massive parts where little or no preheating is practicable and for thin sections, where its low fusion temperature minimizes warping. It is not recommended for corrosive conditions or elevated temperatures. Hardness is 65-67 Rockwell C. HAYNES STELLITE Co., Kokomo, Ind.

A USEFUL BOOK FOR THE WELDOR

WELDING—

ITS QUESTIONS And ANSWERS

By T. B. JEFFERSON

Editor, *THE WELDING ENGINEER*

500 QUESTIONS—each answered clearly and understandably in this informative book. Answers the most important everyday questions of every man interested in welding.

Questions were carefully selected and screened from the most frequently asked by weldors about welding, cutting, materials, flame treating, inspecting, etc. Novice and expert alike can get a lot out of this book. It's easy to read, yet contains a fund of information. By using the handy index you can make this book very useful for quick answers to the questions that come up in your daily work.

- **176 PAGES**
- **ILLUSTRATED**
- **INDEXED**

$1.50

SEND YOUR ORDER TODAY, TO—

THE WELDING ENGINEER

330 W. 42nd St. New York 18, N. Y.

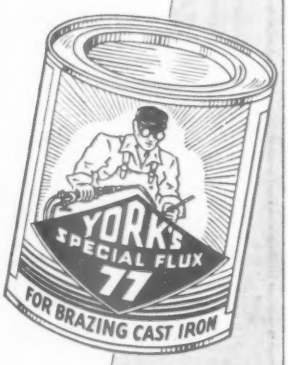
Save Labor!

(WORK ITSELF IS BAD ENOUGH WITHOUT DOING IT THE HARD WAY)

with

YORK'S 77
CAST IRON BRAZING
FLUX

1. Fear of overheating can be forgotten.
2. Cleaning and grinding are unnecessary, because "York's 77" penetrates through grease, oxides, etc.
3. Chipping is unnecessary, because a satisfactory bond can be obtained on oxidized surfaces.
4. Deteriorated cast iron can always be welded successfully with "York's 77."

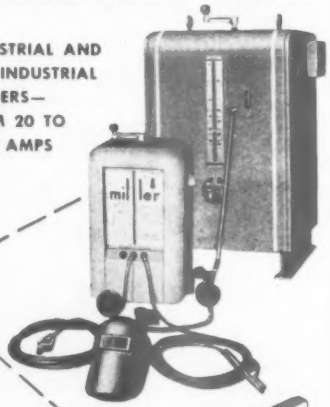


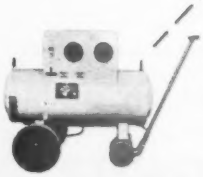
YORK ENGINEERING COMPANY
3349 OGDEN AVE. • CHICAGO 23, ILL.

miller WELDERS
A.C. · D.C. · "HELIARC" · SPOT

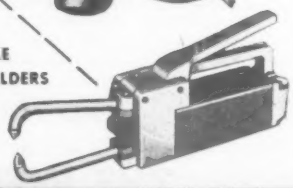
"HELIARC" WELDERS FROM 3 TO 1000 AMPERES

INDUSTRIAL AND SEMI-INDUSTRIAL WELDERS— FROM 20 TO 1250 AMPS





PORTABLE SPOT WELDERS



D.C. AND A.C. WELDING GENERATORS—ELECTRIC OR GASOLINE ENGINE DRIVEN

miller ELECTRIC MFG. CO.
APPLETON, WISCONSIN

OIL-SAVING expansion tank is mounted above transformer to prolong life of oil

Expansion Tank Transformer

EISLER ENGINEERING CO., INC., Newark, N. J., has put on the market a transformer provided with an expansion tank, purpose of which is to conserve the transformer oil by maintaining it in good condition as long as possible.

Air residues, vapor and condensed moisture are collected in the expansion tank, leaving the insulating and cooling properties of the transformer oil undamaged. Illustrated is a 100-kva unit. EISLER ENGINEERING CO., INC., 750 South 13th St., Newark 3, N. J.

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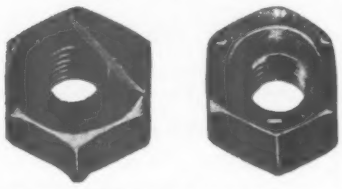


COUNTERBORED "Weld Nut" relieves weld spatter problems. Thread lock design, left

Weld Nut

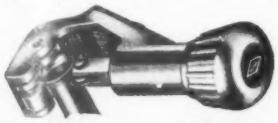
NEW Gripco 3-point-projection "Weld Nut" is said to overcome the trouble sometimes encountered when particles of weld metal drop into the nut threads. Bottom of nut is counterbored a quarter of the way through, allowing metal particles to fall on the counter-bore rather than on the threads. Thickness is increased to compensate for the threads removed by counterboring. Top of the nut is the standard "double triangle" thread-locking design. Three projections for welding contact assure non-rocking electrical connections. GRIP NUT CO., 307-L So. Michigan Ave., Chicago 4.

* * *

Tube Cutter

NEW tube cutter, 274 F, is designed for use with copper, aduminum, Bundy steel, lead and tin tubing in diameters of ⅛ to 1 in. Ball thrust bearing built into the tool provides easy operation and rapid adjustment. Patented flare cut-off

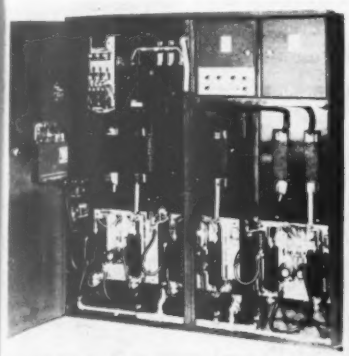
groove in the rollers makes it possible to remove a cracked flare without waste.



BALL-BEARING action on small tube cutter eases adjustments, helps operation. Wt. 6 oz.

Reamer folds out of way when not in use. Cutter is 4½ in. long and weighs 6 oz. THE IMPERIAL BRASS MFG. CO., 1200 West Harrison St., Chicago 7.

* * *



COMPLETE welder control has water saver, timer, circuit breaker, etc., in one cabinet

R-W Control

WELTRONIC three-phase multiple-control combination Model 312KS2 incorporates a remote control relay-timer and provides a variety of multiple welding sequences with independent dial adjustment of weld time on each phase. Equipment includes built-in "Weltronic Water Saver" with solenoid-operated water valve and water lines housed within the cabinet; magnetic contactor for remote control or motor starter; 1 to 3 kva step-down transformer also to supply auxiliary equipment. WELTRONIC CO., 19518 W. Eight Mile Rd., Detroit 19.

* * *

TRIPOD stand for throatless shears, also adaptable for small machines and tools

Shear Stand

TRIPOD shear stand of all-welded construction is being produced by BEVERLY SHEAR MFG. CO., 3009 W. 110th St., Chicago. Stand was designed for the Beverly throatless and slitting shears but is adaptable to other machines and tools. The tubular legs have fittings for several types of anchoring. Weight is 25 lb.; height 30 in.

WELD·CUT·BRAZE
SOLDER·HEAT

...there's a MARQUETTE Torch FOR YOU

WELDING and CUTTING OUTFIT No. 1
PLUS 3 WELDING TORCH COMBINATIONS
WELDING OUTFIT No. 2
PLUS 2 CUTTING ASSEMBLIES
AIRCRAFT WELDING OUTFIT No. 6
PLUS 2 AIRCRAFT TORCH COMBINATIONS
CUTTING OUTFIT No. 9

TAKE HOLD of the Marquette Torch . . . feel how firmly, yet lightly, the handle rests in your hand. With the hose attached, the torch is so evenly balanced that it may be operated at all angles for long periods of time without strain or discomfort.

MIXING SECTIONS are of the latest advanced design to assure thorough mixture and uniform flow of gases. Mixing Sections provide perfect combustion through the complete range of torch tips and gas pressures.

EASY TIP ALIGNMENT . . . Square socket in handle automatically lines up tips in perfect alignment.

CUTTING ASSEMBLIES fit torch handles same as tips . . . you can easily shift from welding to cutting with the speed of tip changing. Enables you to handle all welding and cutting jobs quickly and efficiently.

FOUR COMPLETE OUTFITS to meet every need. Four additional "starter" Welding Torch Combinations. Model D Cutting Assembly fits standard torch handle. Model E Cutting Assembly is designed for use with Marquette Aircraft Torch.

OUTFIT NO. 1 Takes all Welding, Cutting, Brazing and Soldering Jobs in stride efficiently and speedily. This outfit is complete in every detail—Welding Torch, Cutting Assembly, Torch Tips and Mixing Assemblies, Cutting Tips, Acetylene and Oxygen Regulators, Torch Lighter, Oxygen and Acetylene Hose—no extras to buy.

OUTFIT NO. 2 A smaller outfit to which additional tips and cutting assembly may be added later to make a complete welding and cutting outfit.

OUTFIT NO. 6 Aircraft Welding Outfit . . . for welding sheet metal, aluminum and all light gauge metals. This Marquette Aircraft Welding Torch is especially designed for light, fast welding, yet its rugged construction and cool, efficient operation make it adaptable to fairly heavy welding. This outfit contains all necessary equipment.

OUTFIT NO. 9 A heavy-duty Cutting Outfit designed to stand up under hard, continuous service. Cuts metal up to 12" in thickness. Tips for natural or refinery gas are available. This is a complete Marquette Cutting Outfit.

BUY THE BEST . . . BUY MARQUETTE!

Sold exclusively thru the Nation's Leading Distributors

MARQUETTE Welding EQUIPMENT

A.C. ARC WELDERS ELECTRODES
ACETYLENE GENERATORS ACCESSORIES
OXY-ACETYLENE WELDING & CUTTING EQUIP.

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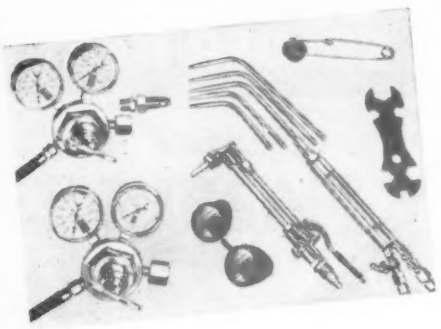

A General Purpose Welding and Cutting Outfit

● DOCKSON'S #145 outfit shown above is versatile and handy . . . capable of handling almost any light or medium welding or cutting job up to 3-inch steel. The #145 is designed and constructed for long, trouble-free service. Scientifically balanced for effortless operation. ● It's a quality kit at low cost.

(Write for welding and safety catalogs.)

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INDEPENDENT Acetylene cylinders take from 5 to 10% more gas. Uniformity of monolithic filler insures even distribution of acetone. Also Oxygen cylinders in all sizes—storage cylinders, in 12 and 20' lengths of 850 and 1500 cu. ft. capacities.

We invite your inquiries on all your cylinder requirements.

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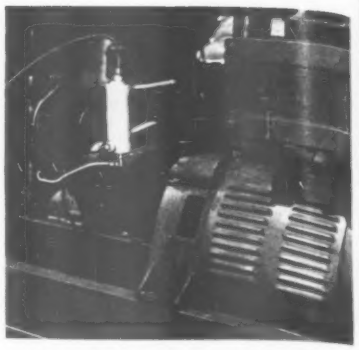
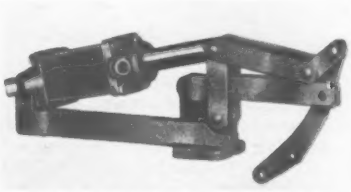


WATER HEATER is plugged into 110-volt outlet overnight, keeps engine water at 120 F

Motor Water Heater

A new motor-water heater permits quick starting in winter of engine-driven welders or the motors of repair trucks. The heater is operated by electrical resistance and maintains water temperature at 120 F., preventing motor oil from becoming stiff. Connection is made to the engine head and the motor drain plug, and heater is plugged into a 110-volt outlet at night. Its operating cost is said to be ⅓ to ½ cents per hour. JOHANSON MOTOR HEATER CO., 817 W. Webster St., Chicago 14.

* * *



TOGGLE ACTION clamps for inconvenient positions, multiple and sequence applications

Weld Clamp

TOGGLE jaw does the actual clamping in a new toggle-action air-operated clamp. A grip is produced by the toggle bar, which acts as a supporting member. Both the bar and jaw swing out to allow free removal of work.

Supporting pressure of toggle bar is 400 lb at outer rivet, and the clamping pressure of toggle jaw is about 300 lb at inner hole. Operating pressure is 85 lb. Overall dimensions with clamp closed: length, 13 5/16 in.; height, 4¼ in. Clamp open, height, 7 15/16 in.; width, 2⅛ in. LAPEER MFG. CO., Lapeer, Mich.

* * *

Stainless-Steel Electrode

A new a-c/d-c stainless-steel electrode has been especially developed to weld stainless-steel types 301, 302, 304 and 308. It is an all-position electrode and is said to show good results in welding high-carbon steel to either low-carbon or alloy steels. Weld deposit has properties equal to those of the parent metal. Proper application is said to give welds of 80,000 to 95,000 psi tensile strength and 35 to 50% elongation in 2 in. This electrode, All-State No. 18/8, is available in a range of sizes from 3/64 to 3/16 in. ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.

Metal Drill

NEW portable ½-in. electric drill is announced by the INDEPENDENT PNEUMATIC TOOL CO., Aurora, Ill. Called the "Silver Line," it is ventilated through slotted ports in the case. It has a free speed of 500 rpm. Length is 11 in.; weight 7 lb.

* * *

CENTERING of motor weight on work in new grinder lessens effort for operator

Vertical Grinder

NEW vertical-type portable electric grinder developed for smoothing welds and castings is able to increase production rates as much as 40%, it is claimed. Weight of the motor is centered on the work, which helps the operator to grind with little effort. Operating speed is 3,400 rpm. Grinder is manufactured in three sizes: 1, 1½ and 2 hp. GASTON POWER TOOLS, 14829 Loomis St., Harvey, Ill.

* * *

PRODUCTION spot welders have eight-step current control, secondary voltage adjustment

Spot Welder

ELECTRIC ARC, INC., 152-62 Jelliff Ave., Newark, N. J., has a new line of production spot welders. Model illustrated features eight-step current control and 75% secondary voltage adjustment. Electrodes are water-cooled and removable. Spring-loaded foot switch is included. Welder operates on 220 volts, 60 cycles, single phase.

* * *

Soldering Stick

"AMCO No. 323" fluxing stick is said to be 100% active flux—no grease, wax or other bonding materials. In addition to its convenient form, the stick is said to contain as much active flux as five two-ounce cans of ordinary solder paste. AMERICAN SOLDER AND FLUX CO., 2156 E. Norris St., Philadelphia 25.

High Strength

Machinable Welds

In Cast Iron . . .

EASIER . . . FASTER . . . CHEAPER

Talk about sound, strong, machinable welds in cast iron. Here's a way to get 'em . . . *but fast* . . . every time. Use Ni-Rod* electrodes"

Ni-Rod's easy-to-control arc speeds up all kinds of cast-iron repair work. Cuts labor, time, and costs. Raises welders' success scores on tough jobs.

Ni-Rod gives you thorough fusion . . . close color match . . . smooth bead that sheds slag. Works on A. C. or D. C.

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*Reg. U. S. Pat. Off.

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No. 4 FLUXINE, in powder form, for welding cast iron with bronze rods.

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No. 18C FLUXINE for gas and atomic hydrogen welding of stainless steels and inconel.

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No. 42 FLUXINE used with Westinghouse Phos-Copper rods and low-melting silver solders on copper and its alloys.

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FLUXES TO JOIN ALL METALS

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PRODUCTION
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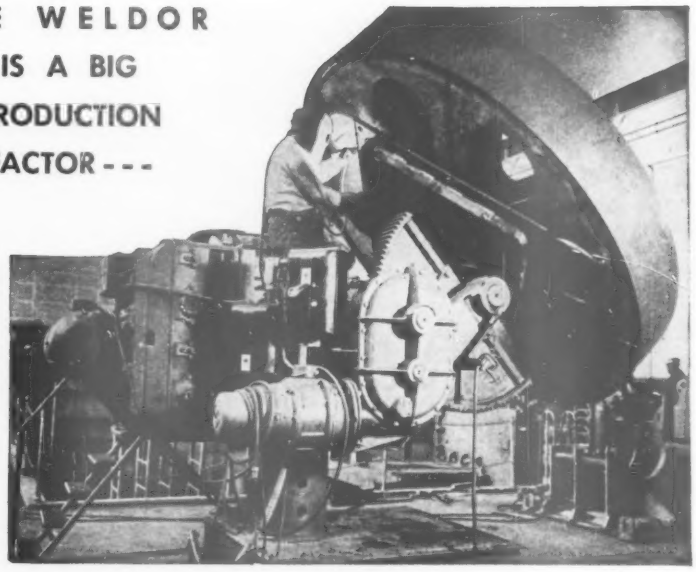

Your weldors are big production factors when they work with C-F Welding Positioners because these power operated Positioners with variable speed table rotation are real production tools. Better automatic welding is possible because the C-F Variable Speed feature governs table rotation speed from 0 r.p.m. and up—assuring better control of fillet in circular or peripheral automatic welding.

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THE CHICAGO HARDWARE FOUNDRY COMPANY
149 ENGINEERING BUILDING
NORTH CHICAGO • • ILLINOIS

WELDING CONFERENCE

(*Continued from Page* 51)

which has much to do with longer tip life and lowered pick-up when welding aluminum.

A three-phase system based upon the use of metallic rectifiers was described by C. E. Smith, of Taylor-Winfield.

Single-phase welding advances were discussed by Ivar W. Johnson, welding section, works laboratory, General Electric Co., Schenectady, whose paper was based upon an investigation to study the effect of varying the amplitude of the current of a standard 60-cycle spot welder during the first few cycles of a spot weld. The "slope," or the rate at which the current rose to welding value, was adjustable in terms of cycles to reach the final current. The numbers of spots welded before sticking occurred (in aluminum of four thicknesses) were, without and with slope control, respectively: 0.025 in., 15, 300; 0.040 in., 25, 825; 0.064 in., 41, 1,125; 0.081 in., 85, 1,700. With slope control in the 0.081-in. thickness, the tests were discontinued at 1,700 spots before sticking occurred.

Maintenance Problems

Because of the previously mentioned trip to the Ford plant, the second Tuesday session was held in the evening instead of the afternoon. The general public was admitted to this event, held in the large main auditorium of Rackham Memorial.

G. M. Chute, General Electric Co., Detroit, acted as chairman of the evening session on the maintenance of resistance-welding equipment. Installation and preventive and corrective maintenance programs were discussed by J. W. Quinn, Delco Products Div., General Motors Corp., Dayton, O.; C. H. Davis, Jr., The Budd Co., Philadelphia, and J. B. Welsch, Cutler-Hammer Inc., Milwaukee.

Ralph Pelton, Precision Welder and Machine Co., Cincinnati, told what instruments were necessary in welder maintenance. First in importance is a sensitive combination meter, which can cover all ranges of voltage, a-c and d-c, and nearly all ranges of resistance except high-resistance, low-output circuits. Next come the cathode-ray oscilloscope,

cycle counter, force indicator for checking and calibrating electrode pressures, capacitor tester, recording oscillograph, tube tester, etc.

B. J. Gelmine, Ford Motor Co., told how Ford is training men for welder maintenance by means of wiring diagrams, sequence operation, telltale method of indication, specially arranged test panels, etc. He presented some slides of the highly elaborate test panels which have been developed to produce any desired circuit condition for classroom study. Upon taking this 40-hour course, said Gelmine, the novice becomes as good a welder maintenance man as the fellow with previous experience.

L. M. Skidmore, General Motors Institute, Flint, Mich., aroused much interest with his description of the resistance-welding maintenance manual that was developed for Fisher Body. This manual is divided into five chief sections—welding, mechanical, hydraulic, pneumatic and electric—and illustrated by over 200 sketches. So far it is available only to maintenance trainees at Fisher Body.

Distribution and Power Supply

Plant electrical engineers came into their own at the Wednesday morning session on plant distribution systems and utility men at the afternoon session on providing power for resistance-welding loads. The first session was under chairmanship of C. M. Rhoades, Jr., General Electric Co., Schenectady, and the second under C. N. Clark, Duquesne Light Co., Pittsburgh.

Papers at the plant distribution session were presented by C. B. Stadum, Westinghouse Electric Corp., Buffalo; R. S. Phair, The Budd Co., Philadelphia; T. Morgan, Buick Motor Div., General Motors Corp., Flint, Mich.; A. W. Brown and S. E. Johnson, Illinois Northern Utilities Co., Dixon, Ill.; and W. K. Boice, General Electric Co., Schenectady.

Papers at the power supply session were by: J. H. Cooper, Taylor-Winfield Corp.; H. B. Wood, Duquesne Light Co., Pittsburgh; H. W. Tietze, Public Service Electric and Gas Co., Newark; E. F. Dissmeyer, Commonwealth & Southern Corp., Jackson, Mich.

To sum up, the first Conference on Electric Welding proved to be an unqualified success. Let's hope that it will be made an annual event.

In coverspecs or regular models. For chippers and grinders as well as welders.

Eyegard "Champions" have 10-way ventilation!

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News of the Industry

WATCHING first tests on a 9-ton box girder at the Ingalls Shipbuilding Corp., Pascagoula, Miss., are D. D. Peattie, machinery superintendent; J. A. Furr, welding foreman; LaMotte C. Grover, Welding Research Council; Dr. Finn Jonassen, National Research Council; and C. P. Goodgame, machine shop foreman. Tom Dawson is taking a reading on the strain gages

Sixth Big Girder Ready for Tests

WITNESSES at the start of residual stress measurements on a large experimental welded box girder at The Ingalls Shipbuilding Corp. shipyards at Pascagoula, Miss., were LaMotte Grover, chairman of the Structural Steel Research Committee of the Welding Research Council, and Dr. Finn Jonassen, technical director of Committee on Ship Steel of the National Research Council. Dr. Jonassen is coöperating with the Structural Steel Research Committee as chairman of its special subcommittee to carry out residual stress measurements on the last of six 9-ton box girders constructed at the Ingalls shipyard.

First five girders were tested under load at the National Bureau of Standards to determine their behavior at various temperatures. (See "Big Beams Break and Bend," THE WELDING ENGINEER, February, 1948). The sixth girder will be virtually destroyed by the removal of plugs to determine whether this type of girder (simulating the hull of a ship) contains unusually high locked-in residual stresses when the welding is done in an unfavorable sequence and by a difficult welding procedure.

* * *

Duluth Distributor Celebrates 25th Anniversary

W. P. and R. S. Mars Co., of 324 West Michigan St., Duluth 2, Minn., celebrated its 25th year as a welding supply nad equipment distributor on Dec. 31. The company is also taking on the distributorship of General Electric arc welders and electrodes in the Duluth area, which includes northern Wisconsin, northern Minnesota, and the upper peninsula of Michigan.

It's L.A. in April For Sixth Metal Show

SIXTH Western Metal Congress and Exposition will be held in Los Angeles' Shrine Civic Auditorium from April 11 to 15. According to W. H. Eisenman, national secretary of the American Society for Metals, which sponsors the event, more than two thirds of available display space has already been assigned.

Coöperating with the ASM will be the western sections of 20 technical societies having a total membership of more than 10,000 engineers and technicians.

* * *

U. S. Steel Supply Moves Headquarters

NATIONAL headquarters of United States Steel Supply Co. warehousing subsidiary of United States Steel Corp., has been moved from 1319 Wabansia to 208 South La Salle St., Chicago.

Warehousing plant and Chicago district operation sales will continue at the Wabansia address, where the first iron and steel company in Chicago, Ward's Rolling Mill, rolled the first steel rails in America in 1865.

* * *

New Laboratory Building For Battelle Institute

BATTELLE Memorial Institute, Columbus, O., is constructing a new $500,000 laboratory building scheduled for completion in 1949. It is the largest of four such structures to be erected by Battelle since the war's end, and will provide 80,000 square feet of floor space for 103 unit laboratories, plus large open areas for pilot-plant operations.

NWSA West Central Meets at Minneapolis

INCREASED welding sales were noted by delegates to the west central zone meeting of the National Welding Supply Association, held at the Hotel Nicollet in Minneapolis, Nov. 4. However, profit margin seemed to be slimmer and inventories were being reduced. Thirty-six members and guests were in attendance. Robert S. Mars, of W. P. and R. S. Mars Co., Duluth, Minn., senior vice-president of the association, presided over the meeting.

Robert C. Fernley, secretary-treasurer, opened the formal discussion with a talk about certain problems the association is studying.

Allan H. Young, Independent Distributing Co., St. Joseph, Mo., presented the paper "Will the New Line Pay?" in which he suggested that it would be wise for the distributor to check his sales territory to determine the prospective volume of a new line.

"Some Margins Should be Increased" was the subject of a paper by L. J. Weisgerber, Mankato Welding Supply, Mankato, Minn. He pointed out that association members should exercise their individual rights to call manufacturers' attention to the need for increased margins to cover increased costs.

Inventory turnover, cylinder problems and the importance of inert-gas-shielded arc welding were also discussed.

T. B. Jefferson, editor of THE WELDING ENGINEER, gave a short talk on the importance of welding to American industry. A recent survey conducted by THE WELDING ENGINEER shows that 85% of all the metal-working plants in the country are using one or more welding processes in production or maintenance.

The following delegates were in attendance at the meeting: John M. Anderson, C. J. Baker, James C. Barclay, Cecil R. Behringer, Ray C. Bender, V. L. Buckles, W. E. Coleman, Leon J. Cohen, Philip Cohen, Robert C. Fernley, Marshall H. Ford, Don Grohs, R. H. Groman, Lewis Hunt, T. B. Jefferson, H. H. Kaehn, Harry Louis, R. S. Mars, R. H. Newton, Roland H. Ogden, Latimer H. Parsons, Norman J. Peters, Roy W. Poe, Dan E. Randall, J. A. Schindler, B. J. Shonka, Leonard W. Skoglund, H. R. Toll, Ray L. Townsend, David R. Warner, L. J. Weisgerber, M. M. Weist, Palmer Wert, Lee O. Wiese, Allan H. Young.

* * *

Gas Manufacturers to Meet At Waldorf-Astoria Jan. 17

36TH ANNUAL meeting of the Compressed Gas Manufacturers' Association will be held at the Waldorf-Astoria Hotel in New York City on Jan. 17 and 18. Monday, Jan. 17, will be devoted to committee meetings, a luncheon and annual get-together of members. On Tuesday a technical program and luncheon will precede the annual reception and banquet.

The Waldorf-Astoria has allotted 50 double sleeping rooms for the use of members. The association office will accept the first 50 reservation requests. Office address is 11 West 42nd St., New York City.

Purdue Welding Conference Scheduled for Feb. 8-10

THE 20TH Annual Purdue Welding Conference will be held at Purdue University, Lafayette, Ind., on February 8, 9 and 10. Lengthened to cover three days this year, the program will include the presentation of papers of special interest to welders and welding shop owners serving both city and farm customers. Exhibits and demonstrations by manufacturers of welding equipment and accessories will also be on view.

* * *

Prizes to Be Awarded For Welded Bridge Design

JAMES F. LINCOLN ARC WELDING FOUNDATION is sponsoring a new "Welded Bridges of the Future" Award Program to advance the progress of welded bridge design.

First award is $3,000 and the second award is $1,500; third is $750. There will also be ten honorable mention awards of $100 each for the next best designs.

The competition opens January 1 and closes June 30, 1949. Any engineer or designer who feels himself qualified to enter the contest is eligible for participation.

Bridge to be designed is a two-lane deck highway bridge supported on two end piers 120 feet apart. It is to be designed for ASTM-A7-46 steel and for H20-44 loading. While the size, steel and loading for the bridge are specified, otherwise the designer is completely free to exercise his ingenuity. If he wishes, the designer may conceive and use new structural shapes not now available, providing only that the new shape or shapes can be readily produced if and when a demand for them develops.

The foundation, according to Dr. E. E. Dreese, chairman of the board of trustees, wishes to give designers an opportunity, free from present limitations and restrictions on design practice, to apply their knowledge and experience to the problem of designing a bridge for arc welded fabrication. Complete details of the contest are available from The James F. Lincoln Arc Welding Foundation, Cleveland 1, O.

* * *

Open Cold Rolling Mill At Pittsburg, Calif.

NEW $30,000,000 cold-reduction sheet and tin plate mill at Columbia Steel Co.'s Pittsburg, Calif., plant has been placed in production. Equipment includes a five-stand, tandem, four-high cold-reduction mill, two two-stand, tandem four-high temper mills, a continuous pickling line and ten rectangular annealing furnaces, which can be moved by overhead crane to 30 different bases. Estimated annual production is 325,000 net tons of sheet and plate.

* * *

Welding Fitting Corp. Converts New Work Space

WELDING FITTING CORP., New Castle, Pa., will begin in January to remodel the former Fisher industrial building for its manufacturing operations. The company will produce forged welding pipe fittings for the chemical and oil industries.

10, 40 and 60 Cu. Ft.
ACETYLENE
CYLINDERS
NOW AVAILABLE
for Early Delivery
60 cu. ft.
40 cu. ft.
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New Low Prices
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- No. 5 Aluminum Flux for Cast Aluminum
- No. 8 Aluminum Flux for Sheet Aluminum
- No. 9 Stainless Steel Welding Flux
- No. 11 Tinning Compound
- No. 16 Silver Solder Paste Flux

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Pressure Piping Code To Be Expanded, Revised

AMERICAN Standard Code for Pressure Piping is to be completely revised within the next two years, according to Frank S. G. Williams, new chairman of the committee which functions under American Society of Mechanical Engineers sponsorship. Mr. Williams is general manager of the eastern division of Taylor Forge and Pipe Works.

Subcommittees were appointed to revise sections of the code dealing with lubrication and with piping systems for power, gas and air, oil, district heating, refrigeration, and corrosion service. A second group of sub-committees includes materials and stresses, standards and identification, instrument piping, mechanical design, liaison with ASME Boiler Code Committee and welding procedures and qualifications.

Corrosion-service piping is a new field heretofore not included in the code. It will include stainless steel, nickel, Inco alloys, aluminum and copper. Special studies were also suggested by the chairman for piping to be operated at very low temperatures, below —20 F.

* * *

Hard-Facing Electrode Developed in Australia

E. M. F. ELECTRIC CO., Pty. Ltd., Melbourne, Australia, has developed a multiple-purpose alloy steel for hard-facing cutting tools and machine parts. The electrode, called "Toolcraft," may also be used instead of brazing to join an alloy tip to the carbon-steel shank or body of cutting tools.

Physical properties of the new alloy are claimed to be intermediate between high-speed steel and hot-working die and tool steel. A high-speed electrode is also available, but produces a less tough and brittle deposit.

Average hardness of the "Toolcraft" electrode is claimed to be 60 Rockwell C. Its running characteristics are said to be similar to mild-steel electrodes.

—McGraw-Hill World News

* * *

Welded Pipes Aid Oil Conservation

How welding is aiding the petroleum industry to conserve oil is told in a recent issue of *The Lamp*, house organ of the Standard Oil Co. of New Jersey:

"Leakage in pipe-line transportation used to amount to one or two per cent in the era of screw-coupled lines. In those days pipe-line walkers did their own caulking jobs on any "sweats" or small leaks which they found at pipe joints.

"But in these days of welded joints, there are not many leaks in modern lines and the walker is replaced by the airborne patrol. The pilot knows that an area of dead vegetation below him indicates a leak in the line. His aerial photographs enable the nearest pumping station superintendent to send out a ground party to make repairs."

MORE EFFICIENT

Snap-tite

THE WELDING HOSE COUPLER THAT'S UNDERWRITER APPROVED

Here's the *efficient* and easy way to connect or disconnect your torch! With Snap-Tite couplers, you snap on or snap off the torch by hand. No wrench is needed. And there's no cross threading . . . no leaky connection . . . no kinking.

Tested and approved by the Underwriters' Laboratories. Snap-Tite couplers are absolutely safe . . . the only automatic coupler that has this approval.

Gas does not have to be shut off at the tank when your hose is equipped with Snap-Tite. Built-in valves close automatically when torch is disconnected.

GET THE FULL STORY NOW. Ask your distributor for a demonstration . . . or write the factory

What zippers are to clothes SNAP-TITES are to hose

COPR. 1947 BY SNAP-TITE, INC. ALL RIGHTS RESERVED

Snap-tite

ERIE, PENNSYLVANIA

Eastern Distributors Meet in Philadelphia

LARGEST eastern zone meeting of the National Welding Supply Association ever held took place at the Hotel Sylvania, Philadelphia, on Oct. 27. Seventy-five delegates from manufacturers and distributors attended.

J. W. Albiston, Maine Oxyacetylene Supply Co., Auburn, Me., the eastern zone vice-president, presided at the meeting, at which three formal discussions were presented.

"Our Experience in Modern Merchandising" was the subject given to J. N. Alcock, Saginaw Welding Supply Co., Saginaw, Mich. He presented ideas on location, use of display panels, layout of the welding stock, a perpetual-inventory system, handling of manufacturers' literature, sales and advertising methods. R. P. McMillan, Southern Oxygen Co., Inc., Bladensburg, Md., spoke on, "The Importance of Giving Manufacturers Maximum Market Coverage in Your Territory."

The advisability of checking on the volume for a new line in a given territory before stocking and merchandising it, was discussed by L. Everett Johnson, Welders' Supply Co., Inc., Cambridge, Mass. Distributors often jump into new lines without giving adequate attention to possible returns, he said, and are often unable to give the manufacturer proper coverage.

Among distributor members attending were: James N. Alcock, H. E. Bailey, Joe Beckett, Carl W. Berner, W. R. Boyd, Tom Butler, E. C. Caluwaert, John J. Dombroski, R. C. Fernley, T. A. Fernley, Jr., Everett Johnson, F. R. Joseph, R. P. Mahony, Roy A. Mansfield, R. S. McCracken, Jr., R. P. McMillan, A. L. Mills, Ogden C. Mills, T. Barrett Quinn, V. S. Rice, W. Rice, Raymond B. Roberts, Wm. P. Roberts, Jr., Ed Rosser, George Schneider, M. R. Semmer, W. H. Smiggs, F. W. Taft, R. C. Waldie, R. Bruce Wall, C. P. Weber, A. B. Williams.

* * *

American Welding Builds Two Plant Additions

AMERICAN WELDING AND MANUFACTURING Co. is expanding its plant at Warren, O., by two additions to be built at a cost of $100,000. Work is scheduled for completion in March.

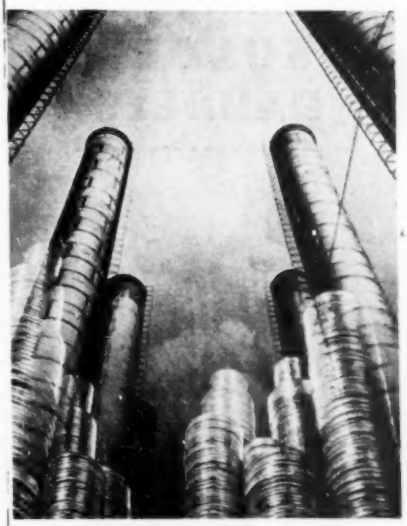
Recently, the company has extended its operations to include fabrication of steel tanks, jet-engine parts, metal doors for homes and factories and railroad specialties.

* * *

Foundrymen to Meet At St. Louis in May

THE 1949 Foundry Congress of American Foundrymen's Society, international technical organization of the castings industry, will be staged in St. Louis, May 2 through May 5. Albert L. Hunt, St. Louis plant superintendent for National Bearing Division of American Brake Shoe Co., has been named general arrangements chairman.

HEAT COSTS MONEY!



Now! Save Money on your Welding Costs—This Quick Easy Way! **All-State low-temperature welding alloys save up to 50% of your gas bills. Why don't you cut costs in your welding shop, as so many others are doing? Turn to *All-State, the Low-Temperature Welding Alloys* . . . learning how to use them takes little more than getting in touch with an All-State distributor.**

Here are some of them:

Knoll Welding Supply & Repair, Topeka, Kansas
McCrelis Welding Supply Co., Bridgeport 4, Conn.
Valley Oxygen Co., Hanford, Calif.
Valley Welding Supply Co., Salem, Oregon
Van's Supply, Long Beach 13, Calif.
Viking Welding Supply Co., Milwaukee, Wis.
Weber-Semmer Co., Pittsburgh, Pa.
Welders Supply Co., Little Rock, Ark.
Welders Supply Co., Rockford, Ill.
Welders Supply Co., Seattle, Wash.
Welders Supply Co., Yakima, Wash.
Welders Supply Co. of Richmond, Va., Richmond, Va.
Welders Supply Co., Oklahoma City, Okla.
Welding Equipment & Supply Co., Detroit 7, Mich.
Welding Supply Co., East Paterson, N. J.
Welding & Cutting Supply Co., Cleveland, Ohio
X-L Supply Co., Cincinnati, Ohio

More have been listed in previous ads.

ALL-STATE WELDING ALLOYS CO., Inc.
80 WEST POST ROAD • WHITE PLAINS, N. Y.

WELDING DISTRIBUTORS

EVERY AUTO BODY SHOP BUYS AND USES

SOLDER PADDLES

- Remont Solder Paddles are made from Hard Maple for long lasting, clog-free service.
- Sell a shop once and you have a satisfied customer.
- Sold only through distributors. Write for particulars now.

REMONT
MANUFACTURING COMPANY
LOMBARD, ILL.

SAVE
Time · Labor · Material
with Tin-Tite
Tin and Fill in One Operation

Instantly forms perfect bond between solder and clean metal . . . Minimum heat—only enough to melt solder . . . Extremely concentrated—every atomized drop is effective . . . Convenient spray application saves fluid; no waste, no spilling, no swabs to buy.

Write for particulars regarding distributorships

REMONT MANUFACTURING COMPANY
Lombard . . . . . Illinois

METAL MELTS ahead of teeth in new 60 in. diam steel saw. Blade turns at 1,750 rpm

High-Speed Friction Saw Built by Steel Supplier

ENGINEERS at United States Steel Supply Co. have constructed a new high-speed, 60-in. metal saw designed to make square, burrless cuts across heavy sections.

At normal operating speed of 1,750 rpm., the friction generated as the teeth contact the steel provides sufficient heat to melt the surface. Then the teeth carry away the melted metal.

* * *

Australian Pipe Line Fabricated by Welding

STEEL pipe sections 24 in. in diameter and 30 ft. long were fabricated by submerged-melt welding for a pipe line from Australia's Darling River to the Broken Hill Mines. The pipes were shop fabricated from 3/16-in. plate and tested to 372 psi, descaled, coated and cement lined. The last 4 in. on the seam not reached by the automatic machine were manually welded.

—McGraw-Hill World News

* * *

B&W Color Film Shows Boiler-Making Steps

NEW 16-mm sound color film "Steam for Power" depicts the historical development and application of modern steam boilers. Steps in manufacture of boilers such as welding, X-ray testing, and pressure testing are also pictured. The film is available for free showings to engineering and other professional societies, engineering schools, and civic organizations. Written requests should be made to the advertising division, The Babcock & Wilcox Co., 85 Liberty St., New York City 6.

* * *

All-Steel Station Wagon Seats 11 to 15 Passengers

NEW all-steel station wagon being built by Autobody Crafts, Inc., 2499 Atlantic Ave., Brooklyn 8, uses welded high-tensile sections throughout. An all-purpose vehicle, it may be operated for both passenger and light freight work. It is expected to be used as a school bus or for plant personnel. Two models seat either 11 or 15 passengers. The steel roof is insulated with two inches of fibreglass, and steel side panels are insulated with sound deadener and lined with masonite.

TILLMAN
GLOVES • GARMENTS

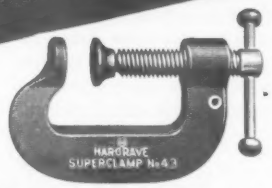
COWHIDE LEATHER GLOVES & MITTENS

- ONE-PIECE BACKS
- WOOL BACK LINING
- WELTED SEAMS
- TWO THUMB REINFORCEMENTS

● ● ●

SEND FOR CATALOG
JOHN TILLMAN & CO.
1561 W. 19th St. Long Beach, Calif.

LOADED?
NOT IF IT'S A
HARGRAVE
WELDERS' CLAMP



SPATTER-PROOF! That's the word for this special Hargrave Welder's Clamp. The screw is made of a patented anti-spatter alloy (solid, not plated) that resists loading permanently . . . speeds welding operations. Frame is forged steel, heat-treated and designed to give greatest strength for weight. Each clamp INDIVIDUALLY TESTED. Openings from 4" to 12".

Write for Catalog Showing Complete Line

THERE IS AN INDUSTRIAL DISTRIBUTOR STOCK NEAR YOU

HARGRAVE
1944 Waverly Ave.
Cincinnati 12, Ohio
The Cincinnati Tool Co.

WOOLDRIDGE ALFLUX No. 3
CAST ALUMINUM BRAZING FLUX

ALFLUX No. 3 is a multiple purpose flux which has been developed especially

for Soldering *and Brazing*
Steel to Aluminum Aluminum castings
Copper to Aluminum Aluminum Sheets

This flux may also be used with good results on other metals. ALFLUX No. 3 is manufactured of the highest quality pure chemicals which have been thoroughly and carefully compounded. It is an exceptionally fine flux which adheres to the surface to be brazed and produces a faster and more economical weld.

WOOLDRIDGE ALUMINUM WELDING PRODUCTS, INC. Glastonbury, Conn.

stop costly DUST here

Aircor
WELDER FILTERS
Eliminate Dust To Maintain
Cooler Motors • Constant Arc
Longer Brush and Rotor Life
Greater Welder Efficiency • Constant Welder Operation • No Shut-downs • Deeper Penetration and Adhesion.
Air Filter Corporation
108 S. North Water Street, Milwaukee 2, Wis.

Houston Welding Firm Builds $100,000 Plant

GENERAL WELDING WORKS, INC., Houston, Tex., has started work on a $100,000 plant to be built off the Katy road. First unit on the two-acre site will be a 60 by 100 ft. building to be equipped with a 25-ton crane. By the end of the year, another 100 ft. section will be added to the first. An ell-section, also 100 ft. long, will be built later.

Company started in October, 1944, with three partners and two employees. Incorporated in 1946, with five owners, the firm now employs 35 men and puts out 200 tons of work per month for refineries and chemical plants.

Officers of the company are W. R. Liner, president; J. C. Nelson, vice-president; A. H. Davis, secretary-treasurer and office manager; and E. E. Taylor, vice-president.

* * *

NEW PROTECTIVE packages maintain electrode quality. Champion Rivet carton at right (above) has a double liner with a layer of asphaltic paper for moisture-proofing. Metal can at left can be sealed for export shipment. Below: All-State Welding Alloys Co. package is of reinforced fibreboard. Instructions and useful hints are printed on ends

Grinding Wheel Production Speeded by New Kilns

NEW type of kiln for the production of grinding wheels has been developed by the joint efforts of three divisions of The Carborundum Co., Niagara Falls. Kiln embodies "zone-firing" methods for scientific control of the firing cycle.

Electric heating elements provide a continuous electric firing operation in the company's "Globar" tunnel kiln. The duplication of wheel quality is said to be controlled to an exact degree and more latitude is provided for development and selection of bonds. Firing cycles have been reduced in time to one-third and sometimes to one-twelfth that of standard equipment.

* * *

AMPCO METAL, INC., Milwaukee 4, Wis., has appointed five companies as distributors: Welding Engineer Sales Corp., Buffalo and Syracuse, N. Y.; Southern Oxygen Co., Inc., Knoxville, Tenn.; Arizona Welding Equipment Co., Tucson and Phoenix, Ariz.; Allied Weld-Craft, Inc., 401 West South St., Indianapolis, Ind.; Welder Service Co., 2037-41 Canton St., Toledo, O.

Tempilstiks°

the amazing Crayons that tell temperatures

A simple method of controlling temperatures in:

- WELDING
- FLAME-CUTTING
- TEMPERING
- FORGING
- CASTING
- MOLDING
- DRAWING
- STRAIGHTENING
- HEAT-TREATING IN GENERAL

Also available in pellet and liquid form

It's this simple: Select the Tempilstik° for the working temperature you want. Mark your workpiece with it. When the Tempilstik° mark melts, the specified temperature has been reached.

$2 each gives up to 2000 readings

Available in these temperatures (° F)			
125	275	500	1100
138	288	550	1150
150	300	600	1200
163	313	650	1250
175	325	700	1300
188	338	750	1350
200	350	800	1400
213	363	850	1450
225	375	900	1500
238	388	950	1550
250	400	1000	1600
263	450	1050	

FREE —Tempil° "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

Tempil° corp.
132 WEST 22nd STREET
New York 11, N. Y.

We invite inquiries from reputable distributors interested in handling **Tempil°** *Products.*

WELDING AND BRAZING

FLUXES

1. TIME SAVING 2. QUALITY PRODUCING 3. PERMANENCE IN RESULTS 4. COST REDUCING

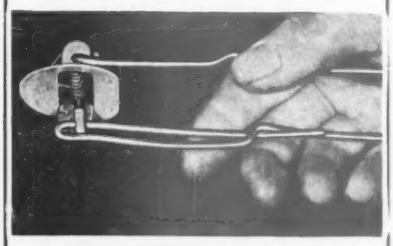
★ When you are welding or brazing get the advantages of METAL BOND products. A type for every need. Each delivers quality results more easily and inexpensively.

★ Make your own test of METAL BOND products. Find out why METAL BOND is so widely used and why users standardize on these products.

★ Send for our handy-size catalog now. It contains much helpful welding, brazing and soldering information.

METAL BOND MFG. CO.
3201 KOSSUTH AVE.
ST. LOUIS 7, MISSOURI

The Welders Favorite



THE IMPROVED "ROUND FILE"

GAS LIGHTER

Many superior design and construction features combine to make the Improved "Round File" the most efficient and economical torch lighter.

An unusually large file area (approx. one sq. in.) is provided. The file is of superior quality, hardened in our own factory. Spark metal is of large diameter and the patented cartridge holding the metal locks exactly into position, permitting instant replacement.

SAFETY GAS LIGHTER CO.
(Est. 1901)
LYNN, MASSACHUSETTS

About People

GEORGE R. MILNE has been appointed operating manager of the National Carbide Corp., New York City, with his headquarters at Louisville, Ky. RUSSELL T. LUND was named assistant operating manager with offices at the Ivanhoe, Va., plant.

* * *

Recent promotions at G-E X-Ray Corp., Milwaukee, include ART PACE, who is now product engineer in charge of radiography and fluoroscopy; JOSEPH W. RANFTL, merchandising assistant, X-ray diffraction; DENNIS VATH and REUBEN HACKBART, laboratory assistants. Industrial sales force includes PAUL MCGRATH for Connecticut and eastern New York; JACK LACLAIR, northern New Jersey; C. F. LEETI, eastern Pennsylvania, northern Delaware and southern New Jersey; RICHARD M. LANDIS, Northern Ohio; and LEO SHELDON, northern Illinois.

* * *

FRANK W. EICHMAN has been appointed sales manager of the Philadelphia plant of Joseph T. Ryerson & Son, Inc. C. H. HALLETT has been named to the same position in the Los Angeles plant.

* * *

HANS A. BOHUSLAV has been named engineering consultant to R. G. LeTourneau of R. G. LeTourneau, Inc. He is a member of American Society of Mechanical Engineers, Society of Automotive Engineers, American Society for Metals, and Society for Experimental Stress Analysis, among other societies.

* * *

L. G. MAECHTLEN is general sales manager of the Square D Co.'s Western Division with headquarters in Los Angeles.

* * *

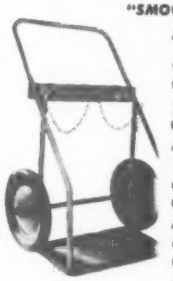
ROY W. POE has been appointed sales manager of Tweco Products Co., Wichita, Kan., it has been announced by R. L. Townsend, partner and general manager. Mr. Poe has had ten years experience in sales promotion and advertising, five years of which he spent with the Kansas Gas & Electric Co. He was in charge of sales promotion and personnel for Swallow Airplane Co. for three years. Mr. Poe joined Tweco early in 1948. His headquarters will be at English and Ida Sts., Wichita.

* * *

JOHN A. PROVEN has been named general sales manager of the Porter-Cable Machine Co., Syracuse, N. Y. Mr. Proven was formerly vice-president and sales manager of Sterling Tool Products Co., Chicago. Besides directing the sales of the company's portable electric tools and grinders, he will also direct sales for Unit Electric Tool Co., Syracuse, division of Porter-Cable.

THE NEW "SUPER DE LUXE" GAS CYLINDER TRUCK

"SMOOTHEST TRUCK AFLOAT"



4 MODELS

CT-600—carries 244 Oxygen 100# Propane Cylinders.
CT-500—carries Oxy-Acetylene Cylinders of 100 to 285 cubic feet capacity.
CT-250—carries Oxy-Acetylene Cylinders of 60 to 120 cubic feet.
CT-100—carries Oxy-Acetylene Cylinders of 40 to 60 cubic feet.

• STURDILY CONSTRUCTED • ALL-RUBBER TIRED • ATTRACTIVE PRICES
• EXTRA WHEELS ON REQUEST
EXCELLENT WINDOW SALES APPEAL FOR YOUR GAS AND APPARATUS.

SOME TERRITORIES OPEN FOR MAJOR DISTRIBUTORS

WHEELS

FOR THE "BUILD IT" URGE

Try this Counter Display. It is an excellent Merchandiser.

WRITE today for full information manufactured by

NATIONAL WELDERS SUPPLY CO.
Charlotte 1, N. C.

Get a Sample FREE and TEST it!

BULLOCK Coated ★ COVER GLASSES

They're SPLATTERPROOF!
WATERPROOF!
EASIER TO SEE THROUGH!
And they OUTLAST OTHERS 10 to 1

Write your name and address in the margin of this page and mail it to us . . . or send a letter. We'll send you sample glasses to test. You'll see in a hurry why Navy Yards, Shipbuilders, etc. used Bullock Glasses by the millions during the war.

Bullock Cover Glasses are coated on both sides. They last longer because their coating protects them against splatter, moisture, heat breakage. They stay clear, clean, uncracked 10 to 20 times longer. One Bullock Glass will last for days . . . no time out for changing . . . no blurred vision . . . no eyestrain. Tear this out now and mail it.

*DEALERS: You ought to be selling Bullock Cover Glasses. Write for terms

15c each
100 for $12.00
500 for $45.00
1000 for $67.50

L.H. BULLOCK CO.
2 EIGHTH ST.
RICHMOND, CALIF.

AMCO #322 for galvanized surfaces damaged during fabrication by welding, bending, forming, threading and similar operations. This stick actually forms a perfect bond with the base metal without damage to surrounding area.

SEND FOR FREE LITERATURE

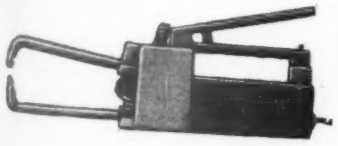
Also available in powder form (AMCO #321)

AMERICAN SOLDER & FLUX CO.
2156 E. Norris St., Philadelphia 25, Pa.

Alphil

"AUTOMATIC"-PORTABLE
(hand type)
SPOT WELDER

JUST PLUG IN—SQUEEZE HANDLE



3 KVA, 110 or 220 Volts
Welds up to 2 pcs—16 Gauge Mild Steel
1 year guarantee

A VERSATILE WELDER
for
Metal and Wire Fabricating Industries. Suitable for Lighting Fixtures, Cabinets, etc. Write for Literature and prices.

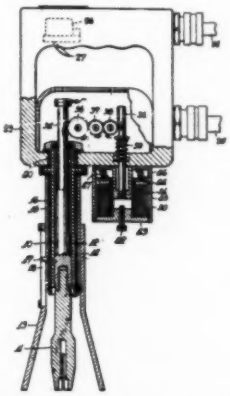
Jobbers Solicited

ALPHIL SPOT WELDER MFG. CO.
1062 PACIFIC ST. BROOKLYN 16, N.Y.

From the Patent Office

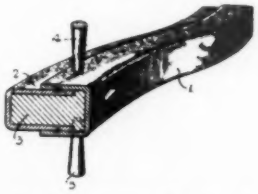
Stud Welding Gun

2,451,152. Albert M. Candy, La Grange, Ill., assigned to National Cylinder Gas Co., Chicago. Filed Oct. 4, 1945. Issued Oct. 12, 1948.



Patent pertains to a stud welding gun having a plunger adapted to carry a stud. An electromagnet in the gun has an armature, and gearing between the armature and the plunger with a portion out of mesh when the magnet is not energized.

* * *



Spot Welding Method

2,451,442. Clarence E. Meissner, Washington, D. C., assigned to The Budd Co., Philadelphia. Filed Mar. 21, 1946. Issued Oct. 12, 1948.

This patent concerns a method of spot welding metallic workpieces having hollow portions subject to deforming by electrode pressure and which hollow portions are irregular in shape. It comprises entirely filling the hollow portions which are to come between the electrodes during welding with molten metal of low melting temperature point compared to the workpiece. Injury to the workpiece by surface melting is therefore avoided, allowing the filler metal to harden. The filler metal is not appreciably plastic under electrode pressure, and transmits welding current efficiently without softening or melting. Current flows directly through without permitting deformation of the workpiece. The filler metal is removed from the workpiece by melting it and letting it flow out of the hollow portions.

G-S EYE SWEEP
Double Purpose MAGNET AND LOOP

AN INDISPENSABLE FIRST-AID INSTRUMENT for removing metallic particles, dirt, chips, any foreign matter from the eye. **$2.50**

Magnetic tip easily picks up the smallest piece of iron or steel. Flexible loop is very convenient for removing cinders, dirt and non-magnetic particles. Sterilization will not affect magnetic properties or loop. A hard rubber carrying case is provided with each G-S Eye Sweep.

ORDER DIRECT TODAY OR SEND FOR LITERATURE

GENERAL SCIENTIFIC EQUIPMENT COMPANY
TESTED INDUSTRIAL SAFETY PRODUCTS
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RESPIRATORS • PUMPS • GOGGLES • SHIELDS • GLOVES • APRONS • HELMETS

W-AL-CO RODS
for Welding of ALUMINUM
ELECTRIC AND GAS WELDING

Drawn Wire
TYPES 25, 43 and 52
Brazing 716

FOR CAST ALUMINUM

Use Extruded Rods
Types 142, 195, 355 and 356
for Better Welding
3/16" size only

Aluminum Solder
White Metal

Welding Alloys Manufacturing Co.
744 Broad St., Newark 2, N. J.

SPOT WELDERS

BUTT WELDERS
GUN WELDERS
WELDING TIPS

•

Eisler manufactures a complete line of RESISTANCE SPOT WELDERS for all types of Welding. SIZES FROM ¼ to 250 KVA

•

TRANSFORMERS

FOR LIGHTING — FURNACES — POWER — PHASE CHANGING — ETC.

Eisler's Transformers are Built to Suit Any Job From ¼ To 250 KVA

also Manufacturer of Machinery for the Complete Production of Incandescent Bulbs Radio and Electronic Tubes.

•

EISLER ENGINEERING CO., Inc.
CHAS. EISLER, Pres.
749 So. 13th St. (near Avon Ave.) Newark 3, N.J.

ALADDIN

ROD AND PATENTED METHOD

NO PUDDLING • NO FLUX

Weld White Metal
(POT METAL - DIE CAST)
Solder and Braze Aluminum
Easily and Quickly
with Gas or Carbon Arc . . .

Melting Point 732° F. Tensile Strength lbs/Sq. in. 47,300. Shearing Strength lbs/Sq. in. 45,800. Meets Air Corps Specification No. 10302. Instructions with every pound. Sizes 1/32", 1/16", 1/8", 3/32", 3/16", 1/4". Complete Assortment, and $1.00 Trial Package.

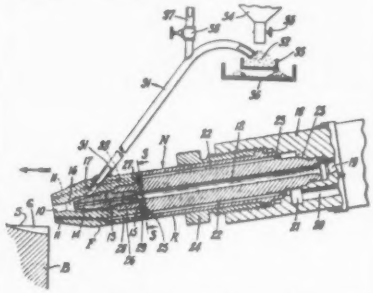
PRE-WAR PRICES

SEE YOUR JOBBER OR WRITE US FOR INFORMATION

ALADDIN
ROD & FLUX MFG. CO.
GRAND RAPIDS, MICHIGAN
Cable Address "Aladdinco"

Powder Cutting

2,451,422. Robert L. Wagner, Niagara Falls, N. Y., assigned to The Linde Air Products Co., New York City. Filed Mar. 24, 1945. Issued Oct. 12, 1948.



A thermochemical metal-removing apparatus has a nozzle having an oxygen passage provided with an outlet for discharging a stream of oxygen into the atmosphere and against successive preheated portions of a metal body. The nozzle also has a number of combustible gas mixture passageways extending lengthwise and spaced apart around the oxygen passage. Mixture passageways have outlets adjacent but spaced apart around the oxygen outlet for discharging combustible mixture jets to produce preheating flames outside the nozzle. They are separate from but alongside and around the discharging oxygen stream to preheat successive portions of the metal body. A container is separate from the nozzle for holding a supply of iron-rich powder. Powder supply conduit leads from the container to the nozzle but is non-communicating with the mixture passageways.

* * *

Soldering Tip

2,448,182. Zoltan Kalfen, Chicago, Ill. Filed July 3, 1946. Issued Aug. 31, 1948.

A soldering tip of high thermal conductivity comprises an elongated fabricated element, a slot extending along a portion of the longitudinal length of the element and beyond its end. Slot is directed inwardly toward the center of the element and extends to a depth slightly beyond the center of the element.

* * *

Spot Welding Adapter

2,449,455. Ernest Crabtree, Toronto, Ontario, Canada. Filed Jan. 2, 1947. Issued Sept. 14, 1948.

An adapter for spot welders comprises a body having a clamp designed to fasten on the electrode arm, disc means rotatably mounted in the body and electrode holder mountable in the disc. Discs are rotatable to dispose the holder at an angle to the axis of the body. Holder is mounted in the discs to hold the electrode at a predetermined distance.

EVER-KLEAR COVER LENS

NINETEEN YEARS OF PROVEN SERVICE

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